JULY, 1961

ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

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Current British Uses of Starch and Dextrine Adhesives page 22

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PALMERTON PUBLISHING COMPANY, INC.

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EDITORIAL

The Captive Plant

It is recognized that a good deal of the business conducted within the adhesives industry takes place within captive plants—that is those plants operated by given companies for the production of materials which are consumed by the companies themselves in their daily operations. A good example would be a shoe manufacturer who operates an adhesives plant which produces shoe adhesives which are used in the manufacture of shoes. How much adhesives business is actually conducted in captive plants? The answers are rather difficult to come by for some fairly obvious reasons. For purposes of the Bureau of the Census, a shoe manufacturer will classify himself as a producer of shoes rather than as a producer of adhesives. One result of this system is, of course, that as far as statistics are concerned, the shoe manufacturer's adhesives activities are lost from the total picture. This gives rise to the impression that the adhesives industry is smaller than it actually is.

One aspect of this captive plant business, however, is worthy of editorial observation. There seems to be developing a movement to "free" the captive plants. And at one level, at least, this is most heartening. An aircraft manufacturer who had been operating a captive adhesives plant and consuming his own output has now seen fit to enter the open market with his products. This means, of course, that this manufacturer has recognized the growth potentials of the adhesives industry and has made a decision to share in this growth. Several other owners of captive installations have made similar moves, and their products are now competing in the marketplace or finding new markets. We hold this to be a rather healthy development from an economic point of view pointing to the continuing development of the entire industry. It cannot be said with any degree of certainty whether this whole concept of captive plants is working either to the good or ill of the adhesives industry either from an economic or a technological point of view. We take the position, however, that any open movement to the marketplace is in itself a healthy manifestation. There is almost a psychological feeling that the captive plant tends to be rather provincial and limited in its outlet, although it may meet an immediate economic need. Certainly, there are adhesives manufacturers who can meet the requirements of any given industry. If, however, the captive plant has the technique, the know-how to enter into the open market, and can successfully meet the needs of other consumers, such action should be welcomed by all in the industry. This is a move to positive growth which, over the long run, should prove to be of advantage to all.

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CONSULTANT'S CORNER

By Dr. Irving Skeist

Silicone-Coated Paper

Question: Can you suggest an adhesive that will perform satisfactorily in a Weber 11 AR automatic bag machine as a bottom paste to bond silicone coated paper to multiwall sack kraft? The silicone coated paper will be used as the inside wall with the coating to the inside of the sack.

Answer: This is a difficult problem as the silicone is inherently abhesive—that is, non-adhering to other materials.

One approach is to incorporate a hydrocarbon solvent into a conventional bottom paste, hoping that the solvent will cut through the silicone coating so that the paste can reach the paper underneath. If the coating is highly crosslinked, however, solvents will be ineffective.

Another approach would be to use a pressure-sensitive silicone cement, obtainable from one of the three silicone producers — Dow Corning, General Electric's Silicone Division, Union Carbide's Silicone Division. Unfortunately, pressure-sensitive cements do not provide highest strength in the finished joint. *Q-192*

Wood to Concrete

Question: We sell church pews, normally made of oak wood, and in most standard installations the pews are screwed into a wood or concrete floor with no difficulty. Occasionally, however, we come across a church where the floor has radiant heating pipes imbedded in the concrete, making it rather hazardous to install pews in the customary manner.

Please let us know if there is any adhesive which could be used for fastening pews either directly to a clean concrete floor or to a concrete floor covered with asphalt tile. We need a strong, not-too-fast-setting adhesive.

Answer: An epoxy cement should give good bonding of the wooden pews to the concrete floor.

The concrete should be cleaned chemically or mechanically. Chemical cleaning of concrete is accomplished by an acid wash (muriatic acid) followed by a strong detergent. The surface must be washed with water and then dried thoroughly.

Alternatively, the concrete surface can be abraded with a grinding wheel or a sander at the spots where it is to be bonded. Loose particles must be removed. The wood should be sanded lightly at areas of contact.

The epoxy should be a two-part adhesive, containing filler, thixotroping agent, and flexibilizer, and setting at room temperature. The filler and thixotroping agent will give the cement enough consistency to fill gaps between wood and concrete, avoiding a "starved" joint. The flexibilizer will give resilience and toughness in this cured adhesive joint. *Q-190*

Insolubilizing Animal Glue

Question: Will you please tell us how to insolubilize animal glue?

Answer: Animal glue is made by hydrolyzing animal protein—hides, hoofs, bones—to get soluble products. The protein is a polypeptide in which some 20 different kinds of amino acids are linked together by polyamide bonds. But many of these amino acids have more than one amine group or carboxyl group, and some also have other groups such as hydroxyl. It is primarily these free functional groups in the protein that make it water sensitive.

At the same time, it is possible to utilize these varied groups to convert the glue into a form that will be insoluble. The glue may be *crosslinked* by reacting it with difunctional or polyfunctional materials—that is to say, by reacting it with chemicals which combine two amino and/or carboxyl groups.

One of the most widely used agents for accomplishing this is *formaldehyde*, which combines with the amines in glue in much the same way that it combines with the amine groups in urea and melamine resins. Formaldehyde may be introduced as formalin (an aqueous solution) or paraformaldehyde (a solid), or the methylol group may be supplied as a formaldehyde derivative. Examples of the latter are dimethylol urea, the reaction product of urea with excess formaldehyde; trimethylol phenol, the reaction product of phenol with excess formaldehyde; and "hexa" or hexamethylenetetramine, which decomposes into ammonia and formaldehyde. Glutaraldehyde also should work; it has been found by the U.S. Department of Agriculture to be an effective tanning agent for leather.

If one of the adherends is transparent, the glue can be insolubilized by incorporating potassium dichromate and exposing to light.

The *isocyanates* offer a tantalizing approach to the problem of insolubilizing protein and protein derivatives. These materials react readily with both amines and organic acids (carboxyl-containing materials). There are obstacles to their use in an aqueous system; but I believe that these problems can be solved in the laboratory. *Q-191*

Dr. Skeist is associated with Skeist Laboratories, Inc., 89 Lincoln Park, Newark 2,

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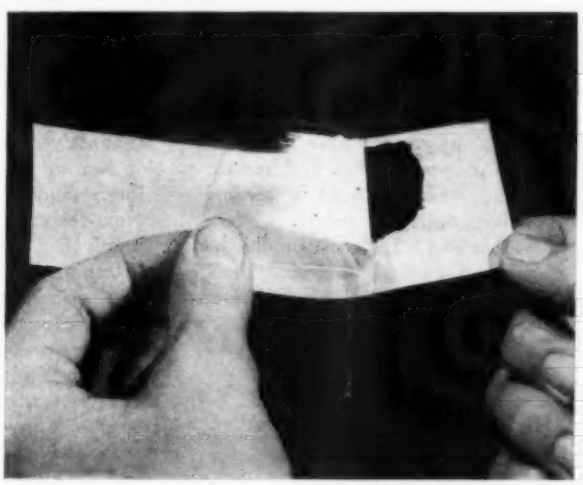
You can obtain tough, flexible adhesive bonds using "Elvax" alone or combining it with waxes, resins, rosins and rosin derivatives. "Elvax" exhibits strong adhesion because of the chemically active polar groups in its molecules. Flexibility and toughness (see upper right) result from its rubber-like, noncrystalline structure and high molecular weight. Hot-melt, solvent and pressure-sensitive adhesives based on "Elvax" adhere tightly to all films used in packaging today (see right).

Since "Elvax" will be used in food packaging applications, Du Pont is currently completing a nineteen-month study which will be used to petition the FDA for permission to use "Elvax" where contact with food is concerned.

"Elvax" is now available in experimental quantities for your evaluation. Our new booklet on "Elvax" provides information on properties and application methods . . . suggests possible uses. Write: Du Pont, Electrochemicals Dept., Vinyl Products Division, Room N-2534, Wilmington 98, Delaware.

FLEXIBILITY is demonstrated by tying a strip of paraffin wax, blended with 40% "Elvax", into a knot. When "Elvax" is added, the strip becomes plastic...will take 50% elongation before it breaks . . . is flexible at –20°F.



ADHESIVE STRENGTH of wax extended with 40% "Elvax" is shown by the fiber-tearing bond obtained when paper coated with "Elvax"/wax is heat-sealed to polyethylene. Coatings based on "Elvax" heat-seal to all films used in packaging today.

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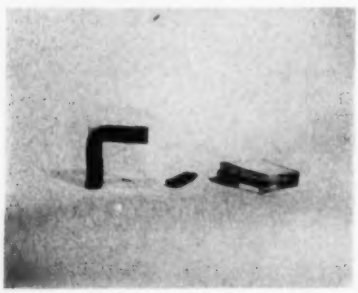
Cross Sectional Sealers

Two new extruded rubber-base sealers with a cross sectional design are said to permit positive sealing of uneven or tapered joints, and 90° bending without the need of



cutting and fitting operations. Designated as EC-2121 (hollow) and EC-2131 (solid) the sealers are designed for use between metal mating surfaces. They perform as a rubbery gasket when pressed into a seam and tightened between the sealing surfaces. Because of their design, they will readily conform and provide a seal around corners. The manufacturer points out that because the sealers have good adhesive properties, they will remain in place even when in a vertical position, until the mating surface is assembled. Surfaces should be free from oil and dirt. *Adhesives, Coatings and Sealers Division, Minnesota Mining and Mfg. Co.* **P-503**

High-Temperature Adhesive

Suitable for use up to 1000°F., Raiseal 350 offers high electrical resistance and low thermal conductivity. It is the latest in the two-part Raiseal 300 series which are said to remain unaffected by water, typical organic solvents and hydraulic fluid. Tensite tests of aluminum lap joints indicate strengths of 675 psi after one-hour soaks at 1000°F., and 450 psi after 24-hour soaks at 500°F. *Radiation Applications, Inc.* **P-504**

Foam-to-Fabric Adhesives

A variety of quality adhesive compounds based on acrylic interpolymer latexes provide industry with adhesives specifically developed for the binding of polyether or polyester foams to various types of textile fabrics, paper, and metal foil. The new adhesives will be of particular importance to the textile industry for thermal garments, the paper industry for insulated bags, and the floor covering industry as a binder for sponge rubber to vinyls. The advantages of these foam-to-fabric adhesives include the fact that there is no foam loss as in fusion processes, no expensive outlay for special equipment, a more flexible hand for the finished product and the possibility of doing piece goods and odd sizes. Only the smallest quantities are required for a successful lamination which means that fabric will retain its flexible hand.

The requirements of the finished product will, of course, determine both the method of application and the desired viscosity to be selected. All adhesives, however, when properly heat treated, provide excellent adhesive and are both wash-fast and solvent-resistant. The recommended heating time and temperature is 3 to 10 minutes at 280 to 300°F. All adhesives are applied directly to the polyurethane foam by either spraying, roller coating, striping or rotogravure printing procedures and the adhesives can be modified in many respects to meet special requirements and processing equipment. *Alco Oil & Chemical Corp.* **P-505**

Synthetic Rubber Sealer

Presstite No. 162 combines an elastic compound tape with a neoprene "core." The use of these two products together is said to provide an elastic bond for a tighter seal, and a resilient cushion for absorbing pressure loads. *Presstite Division, American-Marietta Co.* **P-506**

Bonding Twins

Epoxy and polysulfide resins and amine hardeners are the basic materials of Concresive#1 (a liquid) and Concresive #2 (a paste) adhesive. Concresive #1 is designed to make strong bonds between old and new concrete, between pre-cast concrete sections, and between concrete and materials such as wood, metal, glass, and asphalt pavement. Concresive #2 is a non-sagging epoxy

paste adhesive designed for repair and maintenance where high strength bonds and resistance to weather are essential. It is said to be ideal for overhead and vertical surfaces. Both products, when cured, resist acids, de-icing chemicals, water, gasoline, fuels, lubricating oils and most hydrocarbon solvents. They withstand freeze-thaw cycling, climatic conditions and temperatures from —70°F. to 350°F. Their inherent flexibility accomodates thermal expansion and contraction of concrete structures, the manufacturer points out. *Adhesive Engineering.* **P-507**

Synthetic Rubber Bondant

Protection of bonds against the effects of Type IV jet fuel and Type III aviation gasoline is said to be available with Schwartz Rez-N-Glue 249, a synthetic rubber-base adhesive of medium syrup viscosity. The adhesive is suited for bonding light metal to plastic, and vinyl or cured rubber-like materials to metal, wood, ceramics and other materials. Of a solvent release type, the cold setting adhesive is also highly resist-

...and gives you better results at less cost

Chemlok 607 Adhesive offers unmatched advantages for bonding **uncured** specialty elastomers:

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ant to water, oils, heat and cold. Application is by brush to clean, grease-free surfaces which are allowed to dry to a tacky, touch transfer-free coating. Moderate pressure is required to assure contact between cemented surfaces. A solvent reactivation technique, recommended for bonding non-porous surfaces, reduces trapped solvent and cuts full-strength bonding time. *Schwartz Chemical Co., Inc.* **P-508**

Self-Adhesive Foam

A pressure-sensitive polyurethane foam, Air-O-Plastik Foam adheres to a clean, dry surface after removal

of the backing sheet. Chemically inert and resistant to temperature extremes, the adhesive and foam resist chemical attacks and are proof against fungus, mildew and termites. The foam is available in varying thicknesses, assorted sizes and numerous patterns die cut to specifications. *Air-O-Plastik Corp.* **P-509**

Wire Markers

E-Z-Code Self-Laminating Wire Markers get their name from the fact that each pre-coded unit has a transparent lamination extension. When a coded marker is applied around wire, the remaining clear portion wraps around itself to laminate over and protect the coded area. The system is said to assure permanent legibility of the underlying printed vinyl film. Dirt, oils, greases, etc., are easily wiped away and codes appear clean and visible. *Western Lithograph Co.* **P-510**

P/S Decorative Trim

A low-cost, highly decorative pressure-sensitive material, ideal for a wide range of products, including household appliances, toys, furniture and many other consumer items, simulates leather and other decorative trims. It is available in a variety of attractive colors, styles and embossing patterns. Manufactured from pyroxylin-coated paper, it is believed to be the only broad line of pressure-sensitive products available in a low-cost range. It is said to cost about 40 to 50 per cent less than comparable high-quality decorative vinyl materials, and about 30 per cent less than Mylar-vinyl pressure-sensitives. According to the manufacturer, this highly decorative trim will considerably broaden product applications of pressure-sensitive materials for the design engineer. It makes possible the use of high-quality material on a wide variety of types of products, yet helps keep unit costs to a minimum.

Finished parts can be printed, hot stamped, die cut and fabricated in other ways from the new material, which is washable, durable and soil- and grease-resistant. Initial production work on using the new trim material has already been begun by two of the largest manufacturers of home appliances. One is planning to use the pressure-sensitive material as an overlay for an electric blanket control unit, while the other is employing a die-cut panel for the control front of a room air conditioner. *Avery Label Company.* **P-511**

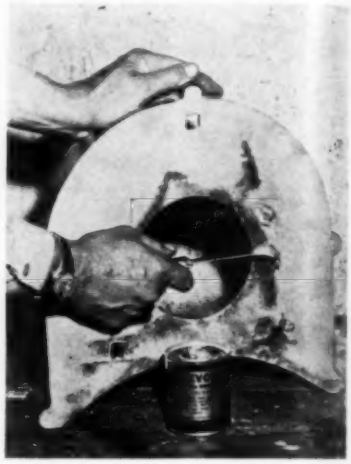
Non-Flammable Adhesive

Treated wood, metals, plastics, ceramics, porcelains, synthetics, etc., can be bonded with Rulabond 988, a non-combustion supporting adhesive. Sprayable, the adhesive is easily applied to any clean surface and dried rapidly for quick lay-up, the manufacturer reports. The formulation meets ASTM specifications for non-flammability. *Rubber Latex Co. of America* **P-512**

FOR MORE INFORMATION on these new products use the Readers' Service Coupon on page 56.

Plastic Bronze

Devcon BR is a repair compound consisting of 80 per cent bronze and 20 per cent plastic. Mixed with a supplied hardener, the formulation cures in approximately two hours



without heat or pressure. Once hardened, it can be drilled, ground, or machined. It will bond to iron, bronze, steel, aluminum, brass, wood, glass and many other surfaces. Tensile strength of the material is 9000 psi; compression strength, 20,000 psi. Unaffected by oil, water, and most chemicals, shrinkage of the material is only 0.0005 per inch. *Devcon Corp.* **P-513**

Fabric Adhesive

Designed for the wet laminating of fabrics to polyurethane foam or other fabrics, a new series of one-package adhesives available is said to be resistant to washing and dry-cleaning solvents, including perchloroethylene and trichloroethylene. It may be used with both polyether and polyester type polyurethane foams.

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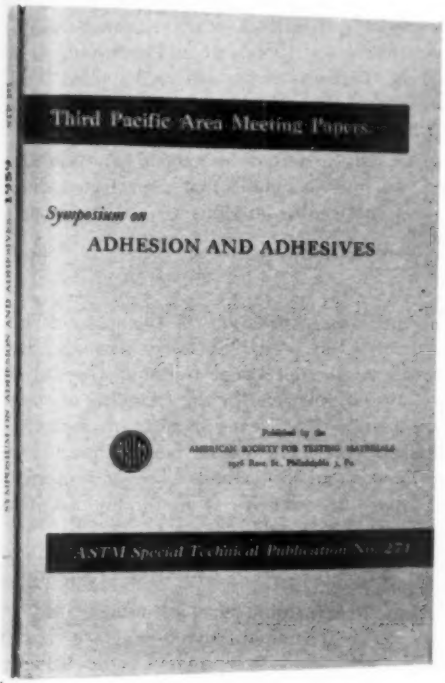

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This volume makes available in printed form material originally presented at the Third Pacific Area Meeting held by the American Society for Testing Materials at San Francisco in October, 1959. It also incorporates data and statistical analysis of a study undertaken to determine the effects of increases in the rate of loading on the strength properties of adhesives.

Although the volume is neither a complete nor an extensive study of the manifold problems relating to adhesives, it does answer some of the many questions of those engineers who have not used adhesives for metal applications and who, with additional encouragement, may incorporate adhesives in their designs.

The volume is a powerful impetus to the use, the technology, and the testing of all adhesives. Metal-to-metal adhesives, relative newcomers to the rapidly growing field of industrial adhesives, have grown in importance to such an extent that no designer can justify overlooking their advantages.

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Lap Shear and Creep Testing of Metal-to-Metal Adhesive Bonds in Germany —By K. F. Hahn, Douglas Aircraft Co.

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● **European Manufacturers of Pressure-Sensitive Tapes Meet.** AFERA (Association des Fabricants Europeens de Rubans Auto-Adhesifs) recently met in Geneva. This association, which started in 1955, has been following up the rapid expansion of pressure-sensitive tapes and was able to convince all the manufacturers to join and pool their efforts.

One committee is charged with developing standards in order to find special sizes and packaging for the same kinds of pressure-sensitive tapes regardless of their origin. Another committee is developing standards for quality control in order to write specifications defining the quality of the various tapes. The committee tries to assist the customers of the industry in facilitating the ordering by making it easier henceforth to judge the quality of the various products.

In view of the ever increasing cooperation between the United States and Europe, it would be worthwhile to have American delegates represent American interests in the future meetings of this influential association.

● **Germany Interested in U. S. Adhesives.** The Institut fur Technische Betreibsfuehrung im Handwerk, Forschungsstelle des Deutschen Handwerksinstitutes e.V., Kanzleistrasse 19, Stuttgart-N, Germany, has prepared a detailed brochure dealing with the use of adhesives for bonding metals and other materials. In its last letter to this column, the Institute pointed out that unfortunately no American manufacturer of adhesives was included in this booklet. However, the Institute is willing to compile a leaflet containing information on American manufacturers and their products—provided that enough American companies send them leaflets and other data.

Because many small factories are members of this organization, useful contacts can be established provided that the literature of the respective American factories is on file in Stuttgart.

● **Pressure-Sensitive Coating — in England.** Although those preparations and their applications have been known for quite some time in the United States, it is amazing how enthusiastically our colleague of the London *Financial Times* describes these preparations. He states that "a new compound which can be applied, it is claimed by the scientists responsible for developing it, to materials such as paper, film, metal foils or other types of industrial materials, to produce a pressure-sensitive adhesive with exceptional adhesion and resistance to softening has been developed. The material is applied to the metal or paper or other surfaces in the form of either an immediately usable adhesive surface or in the form of a surface covered with a special "liner" material. An advantage is that if the liner is left in place the adhesive will remain active for periods of up to a year, yet can be used as soon as the liner is stripped off and removed. At the same time the thickness of the adhesive applied is only 1½ thousandths of an inch — an important factor when engineering parts are involved."

If this is really a new development for the British Isles, then we must conclude that American industry has not been noticeably anxious to sell its products in England.

● **Merchandising Adhesives.** A German company, the Bettermann Elektro OHG in Lendringsen Kr. Iserlohn, appeals to the electrical trade in Germany in offering a special adhesive for the fastening of clamps for electric cables. The clever illustration shows that clamps affixed with "Schellenkitt" will withstand loads weighing more than 350 pounds. The accompanying text notes that the adhesive is easily applied, saves time and is absolutely reliable.

The Disbon-Gessellschaft MBH in Ober-Ramstadt/H. (West Germany) has developed a special adhesive for glass. A leaflet describing the advantages and the application of this special adhesive is regularly inserted in German trade publications read by the flat glass trade, the construction field and others. Some of the American preparations for the same purpose are easier to apply and have a number of additional advantages. There might be a very interesting market for the manufacturers of these special adhesives in Western Europe. The extensive use of flat glass in the building and construction field has only recently started in Western Europe and it is for this reason that this field deserves attention.

● **House Of Plastics.** Part of an exhibit which has been put together by the largest chemical factory in West Germany and shown in Marl is a "house of plastics." It is designed to substantiate the claim that almost 20 percent of the German output of plastics is used in the construction field and is applied in 30 different fields. A very interesting display is devoted to the application of adhesives in the construction. One particular impressive exhibit shows the application of adhesives in joining concrete and steel.

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capitol cues

THE GOVERNMENT'S ANTITRUST CAMPAIGN WILL BE STEPPED UP further in months ahead. In addition to new actions by the Justice Department, there may well be major new legislation by Congress, for the first time in years. The disclosures of price-rigging in the electrical equipment industry have evoked a heavy flood of mail from irate taxpayers. As a result, lawmakers and administrators have decided that even more drastic steps are needed.

The Justice Department's Antitrust Division has been ordered to focus its manpower on cases involving the country's basic industries--even though these are harder to win than cases of local conspiracy in, say, construction or lobster-fishing. And the Federal Trade Commission intends to get much tougher in moving against fraudulent advertising of consumer goods.

On Capitol Hill, Senator Kefauver is going all-out to build a case for antitrust law amendments such as the following:
-Stiffer penalties for individual and corporate violators.
-Liability for top officials of a corporation even in cases where it can be shown that the executives were not involved.
-Burden of proof to be shifted to the companies, from the government, in cases based on a series of identical bids.
Observers give Kefauver's proposals a fairly good chance.

A NEW DRIVE TO PASS A FAIR TRADE LAW has just been launched by its supporters in Congress. They have introduced a "Fair Competitive Practices" bill--a new label to get away from the opposition to Fair Trade. But it would still let manufacturers set minimum resale prices for their products.

The bill's backers hope for House passage this year but know that they face a tough fight in the Senate--probably in '62. But with Senator Humphrey's support, they think they'll win. There's talk Kennedy will veto any such bill. But backers recall that Truman once okayed Fair Trade after veto talk.

TALK OF AN INCOME-TAX CUT NEXT YEAR is being heard at the Treasury. Officials are thinking of substantial relief for upper-bracket taxpayers--and relatively smaller reductions for the middle and lower-income groups. The cuts would have two aims: (1) to stimulate investment in new enterprise and (2) to head off over-taxing that could limit the extent of a recovery. Officials are making no promises. They want to give the question study.

IT'S NOT TOO EARLY TO TALK OF HIGHER INTEREST RATES--maybe by Fall. To be sure, rates seemed to be easing for a time this Spring--though slowly. And officials still want to keep money loose for a while, to spur recovery.

-Long-term rates will probably be the first to respond to the quickening tempo of the economy; indeed, borrowing by corporations and municipal governments is already heavy.
-Short-term rates--90-day loans at commercial banks, for example--may start firming soon, too, as industry starts to accumulate new inventory and to borrow to finance it.

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capitol cues (cont'd)

BUSINESS FORECASTS ARE GETTING EVER MORE OPTIMISTIC these days, as the good economic news keeps rolling in. Some economists with influence in Washington are now talking of an 8% increase in activity by the end of the year--as compared with the first-quarter recession low. This would be a climb almost as rapid as that of 1958--one of the briskest in U.S. history.

> The new programs the President has proposed will help to reinforce the increases in industrial production that have already begun and the coming upturn in business investment. Before 1962 is very old, the economy could be in a boom.

PRESIDENT KENNEDY MUST MAKE SOME TOUGH DECISIONS on foreign policy very soon, to cope with such hot spots as Cuba...Laos...Vietnam...Berlin. Pressure is mounting. Cuba hurt U.S. prestige, and the Reds are grabbing Southeast Asia. More and more, the neutrals are impressed by Soviet gains. The trouble is that none of the counter-policies open to us is attractive.

> In a nutshell, Kennedy must choose policy from three lines:
> -He can pull us out of Southeast Asia on the ground that we cannot win limited wars on the borders of Communism's core.
> -He can go back to massive retaliation, threatening to use nuclear power to curb the Reds. But they have bombs, too.
> -He can spend more for foreign aid and brushfire war, while keeping nuclear force strong. This means bigger deficits.
>
> This third approach is the one Kennedy is coming round to--reluctantly. It's the only line that even our close Allies will back. The path will be slow and frustrating. But the President has started to take the necessary steps--his new defense and aid programs...his revamping of intelligence.

CASTRO WILL CONTINUE TO RIDE HIGH IN CUBA, for a fairly long while. We're not likely to use troops, nor will we attempt to blockade him by sea. And there's little prospect of other Latin nations joining us to topple him. Only an overt act by Cuba--against Guantanamo or, say, one of our ships--would permit us to hit him openly, with support from other American states. But Castro is too smart to try anything, State Department officials believe.

KENNEDY IS SHOWING THE STRAIN of his tense foreign-policy troubles and of his varied domestic problems. He no longer is quite so confident. The criticism he has been getting has sobered him and has forced him to re-examine the way he operates. Example: He now relies more on the Cabinet and is less prone to make the vital decisions solely on his own initiative.

> Kennedy is doing surprisingly well on the domestic front--a fact that's been overshadowed by the loss of prestige on foreign issues. His big setback comes on his tax package. But he's made progress on several key questions--including aid to education--to the astonishment of many observers.

WATCH THE PUBLIC STATEMENTS OF TREASURY SECRETARY DILLON for a tip-off as to future economic policy. He is becoming increasingly influential in key decisions--at the expense of Kennedy's Council of Economic Advisers. These days, Dillon sees no need for crash programs to stimulate business.

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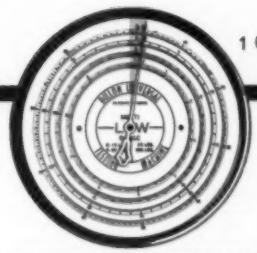

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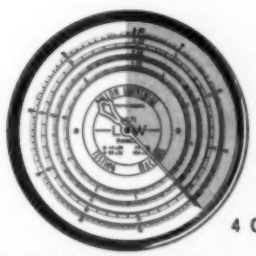

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DISTRIBUTORS IN PRINCIPAL CITIES

By J. F. WHYTE and H. McIVOR
Brown & Polson Ltd.
London, Great Britain

Current British Uses of Starch and Dextrine Adhesives

Though sharply challenged by the synthetics in many applications starch and dextrine adhesives have done considerably better than hold their own

Despite the definite rise in sales of synthetic resin emulsions, the more traditional starch and dextrine adhesives are maintaining a very strong position in the Great Britain adhesive market. Satisfactory performance and relatively low price combine to give the starch and dextrine adhesives a very strong hold on the paper converting field and it seems unlikely that this market will be affected seriously for many years to come.

The story in packaging, where the applications for adhesives are much more specific, is different. Steadily starch and dextrine adhesives are being replaced by the very high-speed synthetics whose performance is beyond the reach of the starch based products. Nevertheless, a portion of the market is covered adequately by dextrine adhesives and on price alone they are unlikely to be supplanted.

A particular instance is in the bottle and container labeling field where the aqueous vegetable adhesives are in fact preferable and cannot be touched on price. Current estimates place the British market for starch and dextrine adhesives in all applications, both in dry and liquid form, at something approaching 56,000 tons per year.

A comparatively large potential is due to the swing from sodium silicate to starch as the adhesive in the production of corrugated board. British corrugating companies have now accepted starch and all new machines are running on it. Some of the older machines are being converted, but generally speaking many will finish their useful life on silicate of soda. In this article the various applications for starch and dextrine adhesives are considered and the particular qualities of these products are compared against the requirements of the application.

Outdoor Posters

Because posters on hoardings or billboards are exposed to the elements, the adhesive used in posting must withstand many rapidly changing conditions. A poster may be fixed in the pouring rain, then have to stand sun, frost, hail, snow and everything the weather can offer.

Ease of application is very important because good tack and slip are essential. A poster may be positioned, peeled and repositioned a number of times to get correct alignment. The adhesive itself must be harmless to print colours and must not penetrate the poster so that dust is attracted to the outside.

The present British system of pasting a tempered poster and then positioning it on the board is gradually going out. The industry is looking at remoistening and in some cases contact adhesives. The industry has labor problems and is trying to reduce the number of men needed to put up the bills.

For the present technique of bill posting, a suitable adhesive is a starch salt conversion that has a wide water tolerance. This type of adhesive is usually white, translucent, and in the form of a stringy mucilage of high viscosity which can be diluted easily in warm or cold water as required.

In Great Britain, biscuits which are sold loose reach the retailer in biscuit tins. Recently a cardboard or corrugated board box of similar dimensions has been introduced and is gaining ground slowly.

The problem of selecting a suitable adhesive for labeling biscuit tins is complicated by the fact that new and therefore greased tins are packed on the same lines as thoroughly cleansed, returned tins. One adhesive must be suitable for both types of surface.

Labels are required to stay in position at least until the biscuits are sold and yet come away quite easily from the tins in the washing plant. As with bill posting the adhesive must not damage print col-

ours, nor should it encourage rusting of the tin, so that the label is damaged indirectly. A semi-hand operation, tin labeling must be carried out with an adhesive that will not irritate the skin and be handled easily with a brush. There are two types of suitable starch-based adhesives: starch alkali conversions and dextrine gums containing special additives. The alkali conversion is most suitable for hand application and the gum for pasting on semi-automatic equipment. Where cardboard boxes are being used the labeling problem is much simpler.

Pre-Wrapped Biscuits

With the advent of the supermarkets, an increasing amount of biscuits are being pre-wrapped in half pound or pound packs. In many cases a transparent film wrapping is used and the ends are sealed by a heat process. Thus, an ordinary adhesive is not required. On some machines a hot melt which is basically PVA containing a plasticiser is used.

A stronghold of the animal glues for many decades, the book binding trade has been attacked strongly by modern synthetic adhesives. Many book binding operations are now carried out with PVA type adhesives, but certain operations are still carried out using vegetable adhesives. For example in "casing-in" a borated dextrine cold glue is employed to bond the paper sheet which covers the inside surfaces of the jacket and the first and last sheets in the book. Such a paste is suitable for machine use and hand application.

Despite a remarkable increase in the speed of bottle labeling machines since the war, the dextrine adhesives have been able to hold their position as premier adhesives. Even on the fastest machines, the dextrine adhesives have been successful and a considerable tonnage is sold for this application each year.

In most labeling machines, the adhesive is transferred across a number of picker plates or belts between glue roll and label. Consequently, a good bottle labeling adhesive must transfer cleanly from one surface to another without threading (premature drying). The adhesive must stay wet on all transfer surfaces and yet have sufficient tack to pull individual labels from the label magazine. Once attached to the bottle, the adhesive must stay firm and set rapidly.

For fast machines the medium brown dextrine gums are the most suitable. They are easily diluted, high viscosity pastes which will run for long periods without threading. In the case of semi-ice-proof labeling, an alkali conversion starch adhesive is used which can be extended with water considerably, without losing tack. Both types will wash off easily in alkali where bottles are re-used.

Only in recent years have machines appeared which will apply

Seams on a four-ply bag are shown being made in the above photograph of the production line at the Multiwall Sack Division of Bowater Packaging Ltd., Ellesmere Port, Cheshire. A cold water-soluble vegetable adhesive is used.

The photograph on the left is a view of the production of sulfite bags for counter use in a private chain. An oxidized starch paste is used. The photograph was taken at the Bolton plant of the Paper Products Division of Bowater Packaging Ltd.

the odd jar labels, *e.g.*, excise stamp labels, neck straps and small price labels. Where no machinery is installed, a hand paste of good quality is required. A suitable adhesive would be a starch salt conversion, an oxidized starch adhesive or a borated dextrine glue.

Starch-based adhesives can satisfy one requirement of the two in labeling cans. The pick-up adhesives are generally non-starch products, but the overlap adhesive which bonds the join in the label is commonly a thixotropic, white dextrine paste. A good overlap paste must not cause rusting of the can, not be harmful to print colors nor cause paper wrinkling and disfigurement. Where a white dextrine paste is not suitable, an oxidized starch paste can be employed.

Little automation has entered the British cardboard box covering trade. A great deal of handwork and semi-automatic operation is still to be found. Sheets of lining or covering paper are pasted in the craddy tray or on bolema belts. After paste application and before final paper fixing there is often an extended period so that the adhesive must remain wet and yet have a good tack when required.

In selecting a suitable adhesive, the paper stock must be considered, particularly where alkali sensitive papers are employed. For the semi-automatic pasting system such as the Stokes and Smith machine, a low viscosity, liquid cold glue is usually employed and a grade of the required color, tack and setting speed required. In Hamden's semi-automatic glue application a dextrine adhesive is common. Where paper warp must be avoided, dextrine gums loaded with china clay are valuable.

Automatic machines of the Hesser type are very common for the manufacture of cartons and their packing and sealing. In the average Hesser there are three different adhesive feed points, paste being applied from each for the liner, the carton blank and the top flaps. Each paste application tray seems to have a different mechanism.

Dextrine Gums and Glues

On the liner, where there is a shallow glue tray and a small diameter application roll, a fairly fluid dextrine gum or dextrine glue is used. At the carton gumming station the machines often have a large application roller and a high viscosity, pasty, dextrine gum is recommended. The adhesive for the carton flaps is normally applied by stamps, taking adhesive from the glue rolls. For this application a fluid type of dextrine gum is used.

The important characteristics for Hesser machine adhesives are good tack, fast drying and strong final bond between liner, paper and carton board. Particularly with delicately flavored food products the adhesive must impart neither smell nor taste.

Must faster machines than the Hessers are on the market for filling and sealing cartons only. These take prepared cartons folded flat. For all types of filling and sealing machines the dextrine glues have proved completely satisfactory, and a range is offered so that all types of machines can be accommodated.

Cartons of packaged goods, etc., are shipped in railing outers. By far the commonest sealing method is the application of an adhesive to the flaps. Case sealing adhesives are graded according to the weight and specification of the case. In some instances a water resistant grade is required. For general internal cases the borated dextrine glues are quite satisfactory.

Adhesives for case sealing must have strong tack, fast initial and final drying speeds and give a fiber tearing bond by the time the case leaves the compression belt of the standard case sealing machine. Price is important and in certain cases the adhesive must be able to penetrate a hard sized liner paper.

In cigarette manufacture, pure starch is the universally accepted adhesive for lapping. The cigarette manufacturers prepare adhesive themselves from raw starch according to their own formulations. The prepared paste is forced through nozzles to give a fine, evenly spreading film with a high bonding speed. On the longitudinal seam the adhesive must be pure, burn without smoke or fumes and meet the rapid bonding action required on the very high speed automatic machinery of the trade.

Dextrine gums have been used for bonding filter tips to the body of the cigarette. Such adhesives are non-toxic, non-irritating, and non-staining.

The Stein-Hall process for the gelatinization of starch *in situ* on the glue lines of corrugated board was introduced in Britain before the war. However, it was not until after cessation of hostilities that starch became accepted as a suitable adhesive for corrugators. Sole rights to the Stein-Hall patent in Great Britain were held by Brown & Polson Ltd. who successfully applied for an extension when the difficulties of exploiting the patent patents ran out. This was due to during the war years.

In the last ten years, the use of starch on the corrugator has be-

About the Authors . . .

J. F. WHYTE, product manager of Brown & Polson's London headquarters, joined the company's Scottish Laboratories after graduating from Lancing College.

H. McIVER has complete responsibility for formulations and developments in Brown & Polson's Adhesives Laboratory. He joined the company in 1936.

A cold water-soluble vegetable adhesive is used in the bottoming department of Bowater's Multiwall Sack Division plant.

Dextrine glues are used in making the seams of envelopes for cornflour at the Paisley plant of Brown & Polson Ltd.

High-speed alkalized dextrine glue can be used as above in manufacturing cartons at Bowater's Belgium factory.

come widespread. Most of the machine makers are loath to sell machines to run on silicate, because the high speeds of modern machines are unobtainable. At the current market prices there is a very significant price saving possible with starch, and there are other important advantages. Most large manufacturers buy raw corrugating starch and cook a corrugating adhesive themselves in a starch plant of the Henry Pratt type. In the case of weatherproof board, it is common practice for the producer to buy prepared liquid adhesive and use it directly as required.

Starch and dextrine adhesives have only limited application in the footwear industry of Great Britain. Soft leather and textile pieces are sometimes bonded temporarily by a starch based adhesive before the final fixing is made by stitching. For such an application a good tack adhesive with an extremely slow drying rate is required. Salt and oxidized starch conversions are used for this application and also for bonding shoe socks, because the adhesive must be capable of absorbing moisture without losing tack and yet dry out again without damage. The glue line must be resistant to mildew and be permeable to air. Starch based products are used as thickeners or extenders for rubber latex used in the manufacture of canvas shoes. The starch compounds provide tack, body and rigidity besides diluting and therefore cheapening the latex adhesives.

Christmas Decorations

The paper decorations used most widely at Christmas time in Great Britain consist of colored papers laminated together and cut to give required shapes. Oxidized starch pastes or dextrine white gums are used because they spread well, dry slowly and give a light colored adhesive film. Care must be taken in garland manufacture because the paper dyes are not very fast and neutral pH paste is preferred. Penetration of the paper by adhesive would cause blocking and this must be avoided.

In the manufacture of solid board cases, a large amount of adhesive is used for laminating the board plys into a rigid material. Because of the very large areas to be glued, the adhesive cost is all important. Dextrines and derivatives are especially important for laminating an outer kraft to inner plys of chip board. The borated dextrine glues are available in a very wide range of fluidities, concentrations etc. to suit all types of papers and machinery, both as powders and as prepared liquids.

The large laminators buy powdered dextrines and make up their own adhesives as required. Small

consumers, as in the case of the corrugated plants, buy fully prepared adhesives and use them without preparation. A large range of materials are laminated by the trade. Kraft, cartridge, chip, straw, etc. may sometimes be laminated to metal foils, hessian sacking, scrim cloths, etc., and these materials often give problems to the adhesive supplier.

In the production of leather, the tanned hides are stretched out on a flat surface and allowed to dry under very carefully regulated conditions of temperature and humidity. The current practice in Britain is to bond the hides to a glass, aluminum or similar flat surface with an adhesive that can be removed after the drying process is completed.

An exhaustive list of essential requirements is given by the leather manufacturer to the adhesive supplier. The prepared adhesive must be stable in viscosity. It must resist micro-biological attack so that the hides are not damaged on standing. Application must be possible either by brush or by spray gun and be harmless to the operator. The bonded adhesive must be flexible to cater for contractions of the hides and adhere preferentially to the fixing surface when the hide is peeled away. After removal of the hide, the adhesive must wash away easily so that the new cycle of operations can be started.

These many requirements are met by an unmodified starch paste containing a small quantity of dissolved corn syrup.

For the labeling of metal drums, cans, railway wagon plates, etc., an adhesive with characteristics similar to a biscuit tin labeling paste is used. In general, starch conversion or a dextrine paste with suitable additives can meet most demands.

The manufacturer of greeting cards has two adhesives problems. Firstly, he must bond pictures or photographs to board, which is a straight mounting. Then he often requires an adhesive which will stick tinsel or powdered glass decoration onto the basic board.

Mounting Photographs

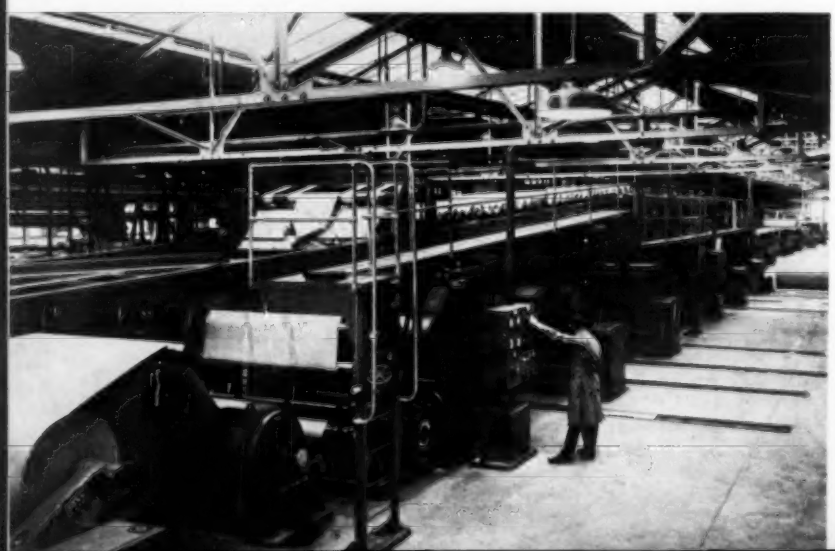
For the photograph mounting a dextrine paste is suitable because it can be applied easily in a thin layer. It has good tack and dries slowly to a colorless, neutral and non-cockling film. If paste application is by roller a borated dextrine glue is used, so long as the print colors will not be affected by alkali of the paste. Dextrine gums with china clay additions are valuable for the mounting of photographs where freedom from warp is essential. Borated farina dextrine pastes are suitable for sticking decorative materials to greeting cards.

The majority of industrial products formerly packed in fabric sacks are now leaving the factories in multiwall paper sacks. As the supply industry increases, the range of products becomes wider. Sacks are being made with open tops or with patent roll filling sleeves. Some are waterproof and others water resistant.

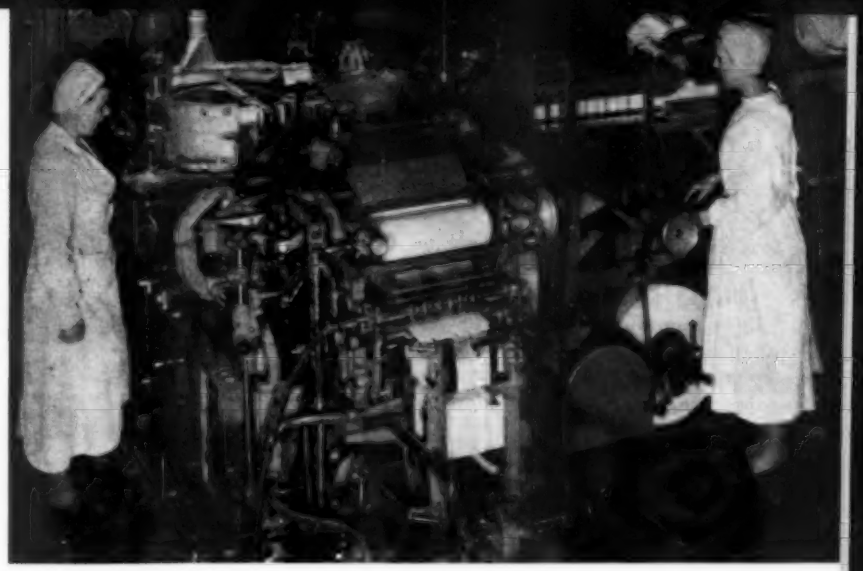
The machines for paper sack manufacture have an adhesive circulation system incorporating a storage tank to hold at least a 24 hours supply of adhesive. Thus, a non retro-grading material is required. The adhesive must be stable against mechanical breakdown and against viscosity change as moisture is lost from the paste trays. There is no standard adhesive as the requirements vary widely. From the starch and dextrine adhesives range, salt conversions, dextrine gums and borated dextrine glues are being used; many users prepare locally from powders, often cold-water soluble.

Starch-based adhesive goes to factors who re-pack into small tins and jars for the general public. An office paste must stand up to a multitude of criteria. It must be non-staining, non-toxic, clean in use and easy to apply. A relatively slow initial drying rate is preferred so that any paper bonded can be repositioned if required. The dried adhesive film should be transparent and flexible.

Custard powders, shampoos and other small quantity dry domestic products are packed initially in small envelopes. These are made on machines of the Honsel type at rates up to 600 per hour. Working at such speeds these machines re-



This Langston Masson 85-inch corrugator at the Milngavie factory of the Fibre Container Division of Bowater Packaging Ltd. runs on a selected maize starch. View of the photograph is from the single facer end of the unit. Most British plants have switched from sodium silicate to starch.



Cornflour is packaged on high-speed machines which form lined cartons from board blank and reeled liner paper. The cartons are made, filled and sealed. Dextrine adhesives of different types are used in the various operations. (Photo courtesy of Brown & Polson Ltd.)

quire an adhesive which must flow on the applicator rolls and yet be pasty or thixotropic enough to prevent splashing at the unit's maximum output.

The borated dextrine pastes have good transfer characteristics and suitable paper penetration at the speeds involved. From the envelope making machine the packs go on to machines which fill and seal. Each envelope is picked up, opened out, filled, glued and sealed. Borated dextrine glues are used on such machines because they meet the requirements of the machine, they are quite fluid and light in color. Where very small envelope flaps are being used the starch-based adhesive gives way to a PVA synthetic.

In the British retail shops, many goods which are not fully packed are wrapped in comparatively cheaply made paper bags. These are made very much down to a price, so a cheap and efficient adhesive is needed to bond the seams and bottom seals. Fully automatic machines are available for bag making.

For the large manufacturers a dry powder is supplied which is cooked on site. A short, pasty adhesive is nearly always the end product although different grades are made according to the paper in use. For example, a faster setting adhesive would be needed where a block-bottom bag is being made because of the pulling action of the freshly folded sheets. A bag maker starting with his own raw materials would buy unmodified wheat flour. If he was taking a prepared liquid adhesive he would have an oxidized starch paste or a wheat flour based material with suitable additives.

A large outlet for starch and dextrine adhesives is in the manufacture of envelopes and paper pads for writing materials. In Britain, the manufacturer of stationery commonly buys dry powders to make down his own large tonnage adhesive requirements, but he will buy in liquid adhesives for special and small tonnage requirements. Any adhesive that needs lengthy preparation or storage is unlikely to be made on site.

Increased Machine Speed

Since the war the speed of envelope machines has increased quite rapidly and each machine has its own type of adhesive. High-speed units require very fluid, short and non-stringy pastes. Flap glues need to be pure, non-toxic, glossy, non-crystallizing, non-hygroscopic and non-curling.

Dextrine gums are perfectly satisfactory, the actual grade being determined by the machine in use. Synthetic resin adhesives have proved vastly superior to starch-based products in binding sheets of paper into pads. However, the oxidized starch pastes are still in use because of their much lower price. Such an oxidized starch paste is particularly useful for pads in which the sheets must separate readily and the flexibility of spine is not really important.

The bulk of the bonding of transparent films in the packaging industry is outside the range of the starch based adhesives because they gel and set by moisture loss. In many cases the transparent film is moisture-proof and the adhesive would not dry out. One or two applications, however, are suitable for these aqueous adhesives; for example, where a transparent film is to be joined to paper or card. The British cake box often has a glassine window in the lid so that the product is effectively displayed. Dextrine glues are suitable for bonding glassine and non-moisture-proof films.

Machine spiral tube-winding and semi-automatic straight winding of straws, canisters, casings, etc., is a good market for starch and dextrine adhesives. Textile bobbin cores, ammunition casings etc. are wound, using tough kraft stock and highly absorbent straw or chip boards. An off-white dextrine is suitable with such materials.

Where a softer paste with short gummy consistency is required, an oxidized starch conversion is suitable. In the more speedy spiral tube winding operations, very fast setting adhesives are required and the high viscosity dextrine glues are used—often applied hot.

Where the outside laminate of a spiral wound tube is to form the

label of a canister, a dextrine glue which will not damage the print must be used. It is true to say, however, that much spiral tube-winding is carried out with animal glue, and some with casein.

In the production of wallpaper in Britain, an adhesive is used for grounding: applying a coating of pigment or mineral as a basis for the main printing. A suitable adhesive for grounding should separate and wet out the insoluble particles, holding them in suspension during storage and application. On the paper itself the adhesive holds the particles so that in effect a continuous film of mineral substance is formed.

For the ordinary grounding an alkali starch conversion which is easily diluted with water and dries to a flexible film has proved very satisfactory. Smearproof groundings and printings have been developed. In these, a drying oil is incorporated which will give the smearproof qualities required, and the formulation may be outside the scope of starch and its conversions.

Wrapping Applications

There are many products on the market which are wrapped, usually by hand, to hold a number of products together. Where the wrapping is a hand operation a low solubility dextrine or a lightly borated dextrine paste may be used. In special instances, such as the wrapping of surgical goods, an oxidized starch adhesive is used because the dry film is colorless, non-staining and will withstand the temperature of sterilisation.

In the packaging industry the starch and dextrine adhesives must yield to the modern synthetics because they cannot bond the new films and similar materials being introduced. There are a few applications in the packaging trade where the dextrine adhesives particularly will hold out for many years to come.

However, the paper converting trade in Britain is increasing at a rapid rate, and it can confidently be expected that consumption of very large tonnages of starch and dextrine adhesives will not only continue, but increase.

By MAURY P. MEDWICK
Adhesive Products Corp.
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New York 60, N. Y.

Problems Are Our Business

Anyone seeking a business as diversified as all of American industry itself can find it by solving adhesives problems. First, however, he has to hang on his office wall that famous World War II slogan: "The Difficult We Do Immediately —The Impossible Takes A Little Longer."

For the truth of the matter is that in the adhesives field, nothing remains impossible very long. If no current approach solves the problem, laboratory work — sometimes years of it—will produce the answer if methods of thinking and working are flexible.

Since Adhesive Products Corp. operates primarily as a problem-solving organization, we've learned to depend on a flexible approach. Problems come to us from every conceivable industry here and abroad. We've gone through our files over the past 20 years to find some typical case histories that illustrate the kind of mental flexibility needed to solve adhesives problems.

The Case of the Self-Adhering Wall Covering—Several years ago a major manufacturer came to us with a vacuum-formed polystyrene sheet in a variety of three-dimensional brick and fieldstone patterns for the do-it-yourself market. Needed: a pressure-sensitive adhesive backing. Problem: the solvent-based adhesives on the market attacked the plastic, making the whole highly salable idea impossible.

To add to this problem, the client needed an adhesive that would not turn brittle below freezing temperatures and, at the same time, would remain unaffected by elevated temperatures. Specifications also called for no loss of self-adhering qualities or tensile strength for a period of five to ten years after application.

After 83 Formulations

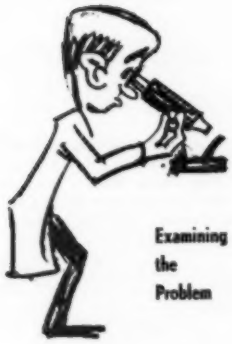
One year and 83 formulations later, our answer was a new, non-inflammable, pressure-sensitive coating that tenaciously adhered polystyrene to any surface without destroying the plastic. It aged well and was easier to apply in production. A high solids content made single-coat application possible, speeding production and reducing costs.

Today, the same coating is used on vinyl and other plastics. A new and still stronger adhesive is now being field-tested to do a self-adhering job on acoustical ceiling tile,

About the Author . . .

MAURY P. MEDWICK is president and founder of Adhesive Products Corp. His interest in adhesives dates from his graduation in 1929 from Pratt Institute.

With more and more industries turning to adhesives in more and more applications, one manufacturer tells how his firm has built its reputation by providing custom formulations for special production needs



ceramic and vinyl-asbestos tile and wood flooring.

The Case of the Multiwall Polyethylene Bag — Moisture-sensitive products which cake or undergo other chemical changes when not protected from condensation are now shipped and stored in the versatile multiwall bag. A vapor barrier film of polyethylene is usually sandwiched between two sheets of heavy-duty kraft paper. The problem is to keep the sandwich from falling apart.

These were the requirements presented to us: the cement must be free-flowing, require no heat or catalytic agents for drying, age well and adapt easily to standard production machinery. It must also, like polyethylene itself, resist moisture, remain flexible at extreme temperatures, resist shock, acids and alkalis. To suit high-speed production, it must also have a fast grab.

Bonding Polyethylene

After extensive experimentation with a variety of adhesives, it became clear that no existing formulation would meet every specification. Our final answer was a product with a polarity that makes possible a bond to untreated polyethylene. It actually results in paper-tear if enough force is applied. This result is achieved through positive bonding, not excessive tack. Now in use by the nation's leading paper and paper-bag producers, the same adhesive, with modified viscosity, has also found wide acceptance in labeling untreated polyethylene containers.

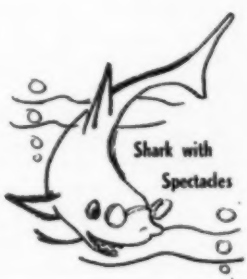
The Case of the Missing Epoxy— In the laboratories of an international publishing concern which issues weekly and monthly publications, chemists had developed a highly economical engraving method that depended on a bond between extremely thin sheets of copper and aluminum.

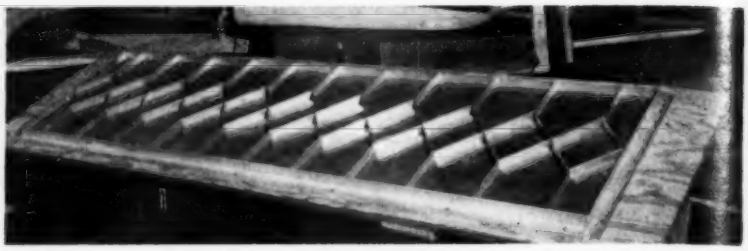
Client Objections

The problem was not a difficult one, we told them. A suitable epoxy would do the trick. But the problem proved harder than that. The client considered epoxies too expensive for what was essentially a cost-cutting innovation. Their limited pot life and toxicity were other disadvantages while their high solids content made it difficult to achieve the minimum adhesive layer the client sought.

Our laboratory staff finally came up with a new isoester polymer on which we had been experimenting for some time. Applied to only one surface, the adhesive dries quickly. After the two surfaces are brought together and heat-sealed, the result is exactly what the client ordered: a strong, fast-working, economical adhesive that is both water- and solvent resistant.

The Case of the Stitchless Tuft— In the crafting of upholstered furniture, stitching was once the only way to achieve desirable tufting effects in the form of blocks, diamonds, sweeps, channels and combinations of these designs. Then foam rubber and other foams seemed to one manufacturer to offer the possibility of eliminating





The first step in making stitchless tufting is to assemble the form of aluminum strips. The form shown here is a diamond design, though any pattern, including curves, can be made.

After the upholstery fabric is laid face down over the form, wooden blocks are pressed into pattern. The blocks are replaced by foam blocks and muslin backing bonded to both foam and fabric.

The operations shown above result in a tufted sofa seat or back which is achieved without stitching. Buttons are generally inserted to eliminate bunching and create an added decorative element.

stitching—if the proper adhesive method could be developed.

In this case, our chemists sat back and let one of our engineers work closely with the furniture manufacturer. A simple jig was developed which is now used by leading upholsterers. It consists of a full pattern board to which one-inch aluminum strips are fastened on edge, like the blades of a cookie-cutter.

Facing material is laid on the pattern and pressed into the spaces between the aluminum strips. Foam blocks of proper shape are then placed in each space where a tuft is desired. A specially developed tufting adhesive is brushed on the backs of these blocks and their binding strips. The same formulation then adheres muslin backing to the entire area. Operators press the muslin down so that it touches the underlying aluminum edges, making a bond between facing and backing materials.

After drying, the whole unit is stripped from the mold and fitted directly to furniture in straight or curved applications. Buttons are pulled through at suitable points to eliminate bunching and give a neater appearance.

The Case of the Liquid Sponge Rubber — Although many of our case histories are now closed files, this one remains wide open. It began a number of years ago when we helped the chenille rug industry increase production and cut costs with a liquid rubber backing that bonded each loop as an integral part of the rug. Chenille sales soared; other rug types also benefitted from the adhesive backing, especially because of its non-slip qualities. But there was an unknown and uncharted area of the situation that still intrigued us.

Why couldn't we develop a compound that would bond loops, be non-slip, and also provide the added resiliency of sponge or foam rubber? After several years of experimentation, we developed a liquid sponge rubber which can be applied directly from the drum. The problem—a pre-foamed compound that was packageable — has now been solved.

Applied as a coating, the new compound dries to form a sponge rubber with normal characteristics of resiliency and strength. Already in experimental use by carpet manufacturers, it bonds, provides non-skid backing and a cushioning layer all in one operation. It can be applied to scatter rugs as well as roll goods. As an acoustical material, it offers some highly unusual application advantages. In upholstering the topping of automobile arm rests, for example, it should prove a great boost to production. A number of podiatrists are now working with the material in the dynamic molding of health and corrective shoes directly on the patient's feet.

The Case of the Aging Pelt — One of the nice things about expensive furs is that they retain their lush appearance for many years. What happens *beneath* the fur and its silk inner lining is another matter. The skin that binds the hair begins to dry, crack and weaken long before outward appearances give a danger signal. When a woman brings her coat to a furrier for remodeling, all of his skill cannot cope with such a skin.

A number of furriers brought the problem to us. Used to typical industrial problems, where strength and durability are prime factors, we were now faced with intangible qualities like "feel," those highly psychological factors that help make mink worth so much more than rabbit.

Needed: a coating with the texture, flexibility, feel and strength of new, well-cured animal skin; a coating that would brush on quickly, cut well, bond old seams permanently, resist tearing, hold stitching firmly and have the effect of rejuvenating old skin to which it was applied. The answer was a vinyl copolymer supplied in liquid form. It is now being used by leading furriers to add years to the beauty and usefulness of furs.

The Case of the Concrete Bond— For many years, the construction industry sought a fastening method that would allow the laying of wood flooring directly to an on-grade or below-grade concrete base. By saving both labor and raw material, such a method would result in significant cost reductions.

Took Two Years

Although some of the problems presented to us are readily answered, this one took over two years to solve because specifications called for a water-based adhesive with a psi of 1600 pounds. In addition, the formulation had to be water-resistant, mildew-proof, heat-resistant and flexible.

After more than 380 formulations, we eventually devised an adhesive that tenaciously bonds parquet wood blocks or laminated blocks to any floor surface including asphalt and concrete. Other construction industry specifications which the bondant successfully met were non-inflammability, reasonable open time, freeze-and-thaw resistance and low cost. The installation method required is standard. The formulation is applied with a serrated trowel and sets up quickly enough so that wood can be tapped down at once. On dry days, sanding can be done 24 hours after installation.

The Case of the Washable Adhesive — This problem came from the garment industry, where designers create new trends in embroidered and appliqued decoration. Fabric cutouts, beads, emblems, and pre-embroidered designs were painstakingly stitched to dresses, skirts, blouses and sweaters. The process was time-consuming and costly.

Bonding Ornamentation

Previous attempts to adhere such ornamentation without stitching resulted in failure. The adhesive did not withstand laundering in soap and water or dry-cleaning in various typical solvents. Our chemists had not only to solve this aspect of the problem, but to create, as well, an odorless, transparent adhesive that was non-staining, light-stable and dried as rapidly as solvent-based types.

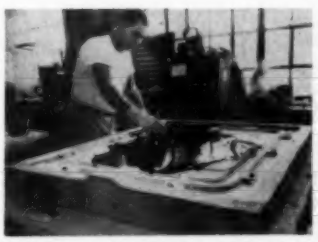
The answer, finally, was found in a quadpolymer emulsion which lasts the life of the garment through repeated washings or dry-cleanings and can be applied by brush, machine, spray, squeeze bottle, flow gun, silk screen or printing press. The formulation also bonds tiny beads, glitter and flocking to fabric.

These have been some typical case histories from the past. We have no way of knowing what tomorrow's mail or telephone calls will bring. It may be, as it was recently, a request from one of the Armed Services for a cement that would adhere spectacles to shark's eyes.

More and more industries are turning to adhesives. This is the clear-cut outline of the present and the certain shapes of the future: more adhesives in more applications, making possible tomorrow what was thought impossible yesterday.

Polysulfide Molds For Ceramic Ware

1 At Crane Co., a polysulfide rubber is spread over a block mold in the first step for manufacturing bathtub bottoms.



2 Wire tabs placed in still liquid compound will facilitate bonding of entire piece after the plaster is poured.

3 Plaster is poured over the hardened rubber case mold cast. The polysulfide is a product of Smooth-On Mfg. Co.

4 Plaster working mold is now separated from the polysulfide case mold. This piece is one of six that form final mold.

High-Strength Adhesive Speeds the Production of Absolute Filters

Interleaving flexible glass paper and corrugated separators is the first step in absolute filter construction.

Filter "piles" are stored in a plastic covered area at controlled humidity. Rough edges are later trimmed.

A synthetic rubber-resin adhesive is simultaneously applied by flow gun and brushed across trimmed filter edges.

Manufacturers of high efficiency absolute filters used for protection against atmospheric contaminants are continuously searching for methods to speed fabrication, cut costs and improve quality. One of the leaders in the field, Flanders Filters, Inc., Riverhead, N. Y., has developed a streamlined production technique sparked by a high-strength, self-extinguishing rubber-based adhesive.

Since 1950, development work at Flanders has been constantly directed toward the production of filter materials and constructions aimed at removing contaminants with minimum pressure drop and maximum dust holding capacity. All signs, particularly in the atomic energy field point to the absolute filter design using corrugated separators of kraft paper or aluminum joined to a glass paper medium as the most economical and serviceable type.

But every solution has its own problem. Joining the separator and the thin glass paper medium demands an adhesive able to meet rigid quality control requirements. The major characteristics required of the adhesive are:

(1) It must be self-extinguishing.

(2) It must be strong and durable and suitable for use with glass paper, kraft paper, aluminum and wood.

(3) It must perform satisfactorily when exposed to temperatures up to 350°F.

(4) It must be resistant to humid atmosphere and to intermittent wetting.

(5) It must be resistant to mild organic and inorganic acids and alkalies.

(6) It must be easy to apply by flow gun as well as by brush.

(7) It must be of the air-drying contact type and be suitable for force-drying with hot air.

(8) It must be able to pass the Army Chemical Center DOP (di-octyl-phthalate) smoke test.

(9) It must be economical to use.

After extensive testing, the company has standardized on an opaque, synthetic rubber adhesive manufactured by Rubber & Asbestos Corp., Bloomfield, N. J. Designated as Bondmaster Z743, the formulation meets all the above requirements and has helped to speed fabrication and keep costs low while providing an absolute filter of highest quality, Flanders reports.

Interleaving Components

The filter manufacturer starts with the interleaving of the glass paper and corrugated separators. When the prescribed number of units has been assembled, the "pile" is removed to a plastic covered storage area where humidity is maintained at 40 per cent.

Prior to bonding, the top and bottom edges are trimmed. The filter, held firmly between metal plates, is then lowered into a vat which forms part of what is called a merry-go-round system. The first coat of adhesive is applied by a suspended flow gun. The gun operator simultaneously brushes the adhesive evenly over the surface.

When the top edge has been

Kraft paper or aluminum bonded to glass paper provides maximum efficiency

Notched edges of the plywood frames are coated with adhesive. When specified, cadmium-plated steel frames can also be jointed using the same adhesive system.

coated, the filter is rotated so that the bottom edge can be similarly processed. The vat is then closed and the filter travels through a hot air tunnel for fast, uniform drying. It then returns for a second coat of adhesive and a repeat of the drying cycle.

At this point, the filter is taken from the vat and the metal plates are removed. It is now ready for assembly in the frame.

Assembling Frame

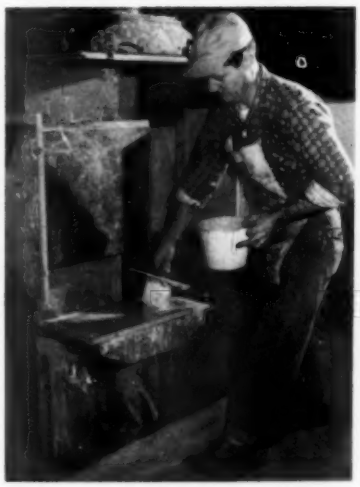
One of the most common frame materials is ¾" AA grade plywood. The first assembly operation involving the frames is the application of adhesive to the notched frame edges. This is done by offset stacking the boards and applying the adhesive with a flow gun.

The individual panels are then placed in an unusual "windmill" clamp type machine and their exposed flat surface areas are brush coated with adhesive. By rotating the machine, panels can be coated in a flat, horizontal position or in the vertical position to suit the work habits of the operator.

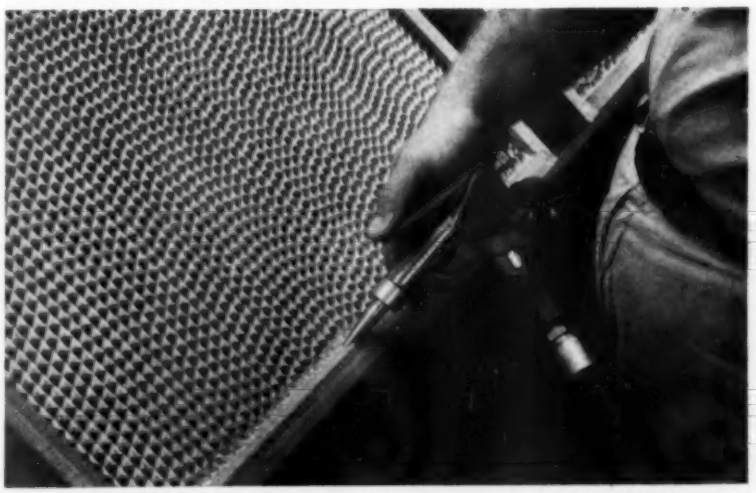
After all sides and edges have been coated, the filter subassembly is slipped into position. The jaws of the windmill press are brought together, assuring uniform pressure and perfect alignment.

While in the press, the plywood frame corners are nailed to provide increased rigidity. Increased stability between the edge of the filter and its frame is achieved by applying a bead of adhesive at both the top and the bottom of the frame.

The windmill clamping press at the Flanders plant permits coating frame side either horizontally or vertically.



When all contact sides and edges of the plywood frame have been adhesive coated, the filter is placed into position.



The completed absolute filter is removed from the press for inspection and the final production step. Above, the unit receives a bead of adhesive between the edge of the filter and the frame. This provides for a bonus of stability.

By C. C. BOOTH and T. F. DUNCAN
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Adhesives and Chemicals Division
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Elastomeric Adhesives: Characteristics and Applications

A discussion of the outstanding properties of various formulations and their uses in applications from buildings to biscuit boxes

During the last decade a class of adhesives called elastomeric adhesives has become well known and widely used in a variety of gluing applications. What are these adhesives and why have they become so popular? The story is an interesting one, and quite fascinating when all of the historical facts are assessed.

Although there is evidence that natural rubber has been used for several hundred years as an adhesive, it was 1826 before the first chemical structure of rubber was established when Michael Faraday showed that natural rubber had the empirical formula C_5H_8. However, it was not until 1879 that G. Bouchardat found that isoprene isolated earlier in 1860 by Greville Williams was the building block of rubber *(1)*. The early 1900's saw considerable research on synthetic elastomer monomers and polymers culminating during World War I with the production of methyl rubber by the Germans. This represented the first large scale production of synthetic rubber.

During the 1920's and 1930's the development of several new synthetic rubbers such as neoprene, polysulfide and butadiene was realized. It is interesting to note that none of these utilized isoprene (natural rubber) as their foundation.

The production of SBR, nitrile and similar rubbers during World War II has been well publicized and their present growth was stimulated during the war years.

The success of elastomeric adhesives is primarily due to the merit of the specific elastomer. By definition an elastomer is a rubber-like material that deforms under stress but is capable of resorting to its original shape upon removal of stress. Elastomers generally utilized in adhesive formulations are natural rubber latex, reclaimed rubber, SBR (formerly called GRS rubber), polychloroprene, polyisobutylene, polysulphide and nitrile rubbers.

Distinction Unclear

Actually, many thermoplastic compounds have rubber-like properties and the line of distinction between them and elastomers is not too clear. One important difference is that although both types of compounds soften on heating, the thermoplastics soften faster and can melt completely, whereas elastomers soften much slower and never completely melt but rather revert to a sticky, viscous state before decomposition. For the purposes of this article, only the seven aforementioned elastomers will be discussed.

Elastomeric adhesives include not only the elastomer but solvents, fillers and additives to impart some desirable feature to the end product. Most compositions contain either thermoplastic or thermosetting resins as a complimentary ingredient to realize the best properties possible from the mutual constituents. Very few formulations contain an elastomer as the sole adhesive ingredient primarily because of the resulting inherently low modulus.

It can be seen that commercial elastomeric adhesives are a complexity of materials designed to give optimum performance in a specific end use. Basically, their use permits the bonding of materials of different polarity and/or components having dissimilar thermal expansion-contraction characteristics. This, however, does not explain the preference of one elastomer over another in adhesive preparation. In order to differentiate between elastomers, it is well to briefly discuss the various types from the standpoint of their outstanding properties.

Natural rubber is a latex ob-

tained from the tropical *Hevea brasiliensis* tree that is most often found on plantations in the East Indies, Ceylon, Malaya, and Liberia. Adhesives containing natural rubber may be supplied as a single or two component system. In the latter instance, the second component is a vulcanizing agent.

Natural rubber has excellent tack and good cohesion which permits instantaneous or very quick adhesion of components. Surfaces coated with these materials may dry tack free and give good bonds many weeks later. Water resistance is considered very good, although not always adequate in highly stressed joints. Severe swelling occurs in oils and solvents, limiting the use of natural rubber in many industrial applications.

Reported to contain twenty three kinds of bacteria, natural rubber is quite susceptible to spoilage *(2)*. Fortunately, ammonia (or ammonium hydroxide) acts as a very good preservative and is widely used for this purpose. The modulus of elasticity of natural latex is one of the lowest of the elastomers, but ideal for some situations. Unvulcanized natural rubber adhesives tend to crystallize at temperatures of —70° F. and lose strength at 160°F. A wider useful temperature range is available through the use of vulcanized adhesive. Incidentally, in the vulcanized state the adhesive is not susceptible to mold or bacteria growth.

Reclaimed rubber is relatively cheap and possesses many properties similar to those of natural rubber. However, a limiting characteristic of reclaimed rubber is its inability to carry any sustained load; because of this, it is only used where minimum strength is required.

SBR rubber is one of the most widely used synthetic elastomers. It is a co-polymer of styrene and butadiene and is commercially available in ratios of 85:15 to 30:70 styrene to butadiene. Formulations range from 40 to 60 per cent in solids content. Extremely versatile, SBR can be compounded to adhere a variety of surfaces or components together. The economics are very favorable since the material is one of the lowest in cost.

Figure 1—An aluminum sheet bonded to a plywood substrate using a protein-neoprene latex adhesive (right).

Figure 2—A metal skin bonded to a metal honeycomb core with a polysulfide-epoxy adhesive formulation (center left).

Figure 3—This flexible vinyl sheet was bonded to a flexible backing sheet with a neoprene adhesive (center right).

Figure 4—High density plastic laminate bonded to particle board substrate with neoprene contact cement (bottom left).

Figure 5—Biscuit canister in which foil has been laminated with a protein-latex adhesive system (bottom right).

SBR rubber is often used in aqueous latex form precluding the need for more costly and hazardous solvents; however, the latter can be employed. Seldom utilized alone due to its poor tack, SBR is often compounded with plasticizers, tackifiers, and other modifiers. It has good water resistance and is similar to natural rubber in this respect. It does not have ozone resistance in a stretched or stressed condition, and is characterized by its low dead load strength.

Nitrile rubber has the outstanding property of excellent resistance to oil and hydrocarbon solvents. Good high temperature resistance *(3)* of upward to 250°F. can be realized by compounding with a thermosetting resin; however, when it is used alone, temperatures of 160°F. can not be exceeded.

Good Shear Properties

This material is also characterized by good shear properties and creep resistance, low water absorption and high abrasion resistance; however, it is inferior to natural rubber in tack. Nitrile rubber is not water soluble and is normally dispersed in methylethylketone or ethyl acetate solvents. In instances where the solvent may adversely effect the adherend, aqueous nitrile latex systems are available. These have properties similar to the solvent based adhesives except that heat and water resistance are not as good.

Polychloroprene (neoprene) possesses many of the same properties of nitrile rubber. This rubber is normally used in aqueous systems and is often compounded with resins, fillers, oxides, etc., to modify tack, heat resistance, aging, and strength characteristics. It has excellent cohesiveness, and in certain compounded systems this outstanding characteristic is taken advantage of to allow the adhesive to adhere to itself. These compositions are commonly known as contact cements or self-seal adhesives. In general, neoprenes have good crystallization resistance; excellent resistance to oils, solvents and certain chemicals; possess good wet tack; and are superior to other rubbers in that they will sustain loads of 25 to 600 psi for extended periods of time *(3)*.

Polysulfide adhesives are normally supplied as a two component system in which one is the liquid rubber and the other a curing agent which generally contains plasticizer and solvent. This adhesive is characterized by a high molecular weight and is quite impermeable to vapors and gases. It possesses outstanding aging and weathering characteristics; excellent resistance to sunlight, ozone and oxidation; and has good electrical properties. The service temperatures range is quite broad, —65° to over 200°F. These adhesives adhere well to many surfaces and are excellent for bonding impervious materials, since no solvent loss is required during cure. Bonds imparted by the polysulfide remain flexible at a —75°F. *(3)* Some variants exhibit a very unpleasant odor, but this condition can often be minimized in compounding.

Polyisobutylene and butyl rubbers have excellent weathering resistance and low rate of water absorption. They do not make good adhesive bases due to excess cold flow. Good aging properties, however, make them ideal for a base in sealers, *i.e.*, for example, auto windshields. Butyl rubber is not resistant to oils and hydrocarbon solvents, and swells in these mediums; however, in polar solvents such as ketones and esters little swelling is evident. Corrosive chemicals such as mineral acids have little effect on this elastomer. The elastomer also has excellent electrical resistance properties as well as low permeability to vapors and gases, being about ten times as impermeable as natural rubber.

"About ten times as impermeable as natural rubber, butyl rubber also has excellent electrical resistance properties . . ."

General Applications Only

In view of the tremendous number of formulations commercially available, and their widespread end uses, it is impossible to cover all applications within the scope of this article. Consequently, only the general fields of application will be discussed here.

Metal to Ligno-Cellulosic — One of the early uses dating back to over a quarter of a century is the bonding of sheet metal to plywood or similar substrates. A protein-natural rubber latex adhesive was successfully formulated for this purpose and has remained substantially unchanged through the years. One essential difference has been the use of neoprene in recent years to replace the natural rubber latex. The theory on adhesion here is that the protein adheres to the wood while the latex bonds the metal component. Both adhesive constituents are compatible and form a mutual bond between the two adherends.

Figure 1 shows an aluminum-clad plywood panel bonded with a protein-latex adhesive. This type panel is often used in fireproof structures. A similar application is the bonding of metal foil to hardboard or similar rigid substrate. Analogous to this is the coating of foil with an adhesive for subsequent use in burn-proof furniture. In the latter application, the foil is pressed between the face ply and x-band for use as a heat conductor.

Polysulfide-epoxy, polysulfide-resorcinol or phenol-resorcinol combinations will also successfully bond metal to wood. However, these materials are rather costly and uneconomical except for certain specialized situations. Neoprene contact cements find some limited utilization, but are much inferior with

respect to heat and water resistance to the protein-latex combination.

Metal-to-Metal Bonds — Depending on whether components are similar or dissimilar, thermal expansion-contraction characteristics can be quite severe in that tremendous stresses within the adhesive film are set up. Polysulfide-epoxies and neoprene contact cements are utilized for bonding metal to itself.

The former combination has proven ideal where high temperatures may be encountered—such as in aircraft components. The epoxy adheres well to the metal while the rubbery polysulfide imparts flexibility to the film. Formulations can be designed for a specific job where the need arises. Figure 2 shows a metal honeycomb section bonded with a polysulfide-epoxy adhesive.

"... where the solvent of the cement attacks the plastic film a water-base neoprene cement usually proves to be satisfactory."

For Low Stresses

Neoprene based adhesives are employed where low stresses are developed or where mild heat resistance can be tolerated.

Flexible Coverings and Fabrics— In recent years there has been a decided trend toward the bonding of thin natural wood veneers and plastic sheet to a flexible backing sheet, comprised of paper or cloth. This provides a very flexible wall covering that is ideal for paneling or remodeling purposes. Elastomeric adhesives, principally the neoprene based materials, have found good acceptance as the bonding agent. The components can be laid up with either a wet adhesive or with the contact variety requiring only contact pressure to form a bond. Figure 3 illustrates this type of application showing the type of materials that are bound together.

Laminating Overlay Materials to a Rigid Substrate — This type of application encompasses not only the high density laminates, but also includes the newer innovations of flexible plastic sheets that are usually bonded to a rigid or a semi-rigid substrate. Contact cements find great popularity in bonding high density laminates because of their ease of use and the need for only contact pressure to combine components. These features are particularly appealing to the small fabricator because only limited equipment is required. The big plant utilizes these advantages to obtain high speed production that would be difficult with thermoset adhesives.

Neoprene adhesives, including contact cements, are also adaptable for gluing plastic sheets. In cases where the solvent of the cement attacks the plastic film, a water-base neoprene cement usually proves to be satisfactory.

Neoprene-protein formulations are often used for these applications, but they require a pressure period of some duration. Natural and reclaimed rubber adhesives can also be employed, but may have the disadvantage of being more costly. Figure 4 illustrates a typical high density laminate bonded to particle board.

Largest Outlet

Packaging—Paper and Plastics Materials — Probably one of the largest outlets for elastomeric adhesives is in the field of packaging. An adhesive used for this purpose must not only possess the ability to provide adequate adhesion, but must be of proper viscosity or consistency so as not to throw off the applicator wheel. High production speeds in the packaging industry also require an adhesive having high wet tack and fast setting characteristics.

In laminating, a protein-neoprene latex combination is generally preferred because of superior water resistance, although styrene-butadiene and natural rubber systems also find some application. These systems provide excellent adhesion of metal foil to paper, and are characterized by water-resistant, flexible bonds suitable for subsequent tube winding.

Elastomeric adhesives are also ideal for adhering to polyethylene or wax coated paper stock and for gluing inserts in plastic bottle caps. Figure 5 is a picture of a biscuit canister in which the foil has been laminated with a protein-latex adhesive. Incidentally, three adhesives were used in this construction.

Hot Melt Adhesives

The ability to soften with heat yet solidify quickly when cooled makes hot melts ideal for heat sealing in packaging. Adhesives of this type may contain polyisobutylene or butyl rubber either as the film forming resin or as a plasticizer. These systems are often compounded with resins, plasticizers, pigments, fluxing agent, dyes, and stabilizers.

Paper Coatings — Pigmented casein has been the prime system utilized in paper coating for many years, and it has only been since World War II that elastomers have made any serious inroads on this monopoly. The most successful application of elastomer containing paper coatings has been in the field of pigmented coatings where the ratio of pigment to binder may be as high as seven to one. Providing a coating material of excellent mechanical stability and good water resistance, the elastomer allows the manufacturer to operate at a higher solids. Pigmented coatings of this type are compounded with the elastomer, protein or starch, clay and pigment.

Styrene-butadiene has been one of the most suitable elastomers for this application—normally in the ratio of 60 styrene to 40 butadiene. Systems having more than 70 per

cent styrene fail to give a continuous film, while combinations having less than 55 per cent styrene provide tacky films. Another type is butadiene-acrylonitrile that provides a tough flexible film which exhibits good resistance to solvents, water, and grease.

In some circumstances, neoprene, styrene-butadiene copolymers and acrylonitrile-butadiene copolymers have been added as beater additives to pulp for use in paper manufacture. Accelerators and vulcanizing agents are often incorporated to impart specific properties.

Pressure-Sensitive Tapes — Because of their excellent tack and cohesive properties, natural and reclaimed rubber have found widespread use along with neoprene based products in pressure-sensitive tapes. The chances are good that the membrane connecting dry wall panel sections in your home utilizes one of these adhesives. Masking tape, that universal "handyman" around the house and industry, is another example of application for these rubber adhesives. A nitrile elastomer adhesive is used as a tiecoat in the manufacture of vinyl masking and surgical tapes.

Tapes for splicing wood, electrical insulation and other similar jobs further exemplify uses of natural and reclaimed rubber. One recent innovation has been the development of flexible, wood veneer faced tapes for edge bonding furniture panels. These tapes replace the more conventional technique of bonding a wood strip or veneer by means of heat and pressure. The possibilities of this system are just being exploited.

The ultimate in using pressure-sensitive tapes is reportedly sticking a toupee to a human's head.

Tile Cements—Several elastomers serve as prime ingredients in cements or adhesives designed for adhering different types of floor and wall tiles to concrete, plaster or wood. Natural and reclaimed rubber find their way into cements for rubber and ceramic tiles laid over cement. Natural rubber also serves as an additive in cement screeds, imparting certain desirable binding characteristics.

Affinity for Vinyl

Nitrile rubber has a special affinity for vinyl tile and is used not only in the adhesive for installing the tile to the floor, but also is utilized as a laminating adhesive to adhere the vinyl film to the asbestos underlayment in the tile itself. The SBR elastomer-based cements also find application in installing both vinyl and rubber tile floors.

Miscellaneous—The applications enumerated are just a few of the more general ones where elastomeric adhesives are used to advantage. There are many others, some of which are highly specialized. In summary, it might be well to mention briefly a few of the more interesting ones not yet discussed to fully appreciate the wide scope of applications that elastomeric adhesives cover. Natural rubber adhesives have been employed for bonding shoe insoles, setting bristles in brushes, bonding nitro-cellulose leathercraft to hardboard for automobile interiors and trimmings, and for laminating canvas and clothing articles, such as shirt bands. In addition, they have found use in the fabrication of carpets and as a self-sealant for mattress bags.

Neoprene adhesives are utilized as a base for sandpaper, as a binder to improve the chemical resistance of mortar mixes, and as a binder in certain gasket materials. More recently, they have found a novel outlet as a non-skid medium on the backs of rugs — particularly throw rugs.

Polysulfide elastomers in combination with epoxy resin have been successfully used as a binder for concrete road patching, and as an adhesive for bonding materials to concrete floors in a watertight bond. This system also makes an excellent adhesive for bonding aluminum oxide grits to steel to provide non-skid surfaces on bridge decking. Polysulfides have recently created considerable interest as sealants in curtain wall constructions, particularly with aluminum paneling.

SBR rubber base adhesives are extremely versatile systems and adhere to a variety of surfaces such as steel, polystyrene cellophane, cellulose acetate, paint, wood and glass. In addition, they have enjoyed some success for bonding steel partitions.

It can be seen that elastomeric adhesives perform many bonding jobs, both large and small. Many of these tasks are so routine now that little attention is given to them while others provoke extreme interest due to unusual or difficult requirements. Whatever the circumstances, this class of products has established their ability as adhesives. There is every reason to expect newer applications to be found for them in the future.

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Are Your Employees "Dressed to Kill?"

In any industry, proper work clothing is of paramount importance. Safety, creating a good impression on the public, higher productivity, company advertising, and high employee morale are all closely tied up with the work garments your employees wear.

Accident prevention is probably the most important pragmatic result of proper uniforming. No company executive today needs to be reminded that the cost of accidents has almost literally skyrocketed into outer space. Awards of $100,000 or more have become commonplace. A uniform program can play a significant role in reducing accidents and is the very cheapest kind of insurance against such costly mishaps.

Let's take a look at what this means to you, a practical executive in the adhesives industry. What are some of the chief possibilities for accidents in your plant? Mishaps with moving machinery; crippling falls; and burns, infections, skin irritations and the like, would rank very near the top.

The chances of having any such accidents in your plant are drastically reduced if your employees are wearing a safe, well-designed work uniform. If, however, your employees are furnishing their own work garments—the kind of nondescript, worn-out clothing that "isn't good enough for anything else"—you are inviting an accident. Such employees are literally "dressed to kill."

Garments with missing buttons, tears, long neckties, trouser cuffs, etc., can easily catch on projections or get snarled up in the hungry jaws of moving machinery. Bone-breaking or maiming falls can result.

Burns are another hazard in today's industry. Certainly, work uniforms which have been soaked with flammable materials increase this hazard. Wearing such garments for an extended period of time is definitely dangerous. Nevertheless, where employees furnish their own work clothing, this often happens simply because the family washer usually can't do a decent job of removing such stains.

What to Do

How do you meet these safety hazards?

The best way is to have your workers use uniforms that have been designed with safety in mind and see to it that work garments are carefully maintained at all times. Work clothing is far more closely tied in with industrial mishaps than many have realized. Any defect in work clothing, if neglected, can lead to trouble. Rips, tears, and lost buttons can cause accidents.

Choosing a work uniform isn't as easy as it looks. It can result in costly mistakes. For example, one inexperienced executive chose a uniform modeled after that worn by a five-star army general-and did the general several points better by tacking onto the uniform a number of gaudy, "fruit salad" features. Of course, the uniform was not suited to on-the-job conditions.

First of all, it could not be laundered but had to be dry cleaned. Under the company plan, the employees were supposed to have this done very frequently at their own expense. The men resented the high cost of dry cleaning the uniform. Some wore it for weeks—even months—without cleaning. Others tried to launder it in the family washer.

The results were most embarrassing to the company—its employees looked like fugitives from Skid Row. The uniform was abandoned with considerable financial loss.

Operators of industrial laundries which supply and service hundreds of thousands of workers' uniforms, have reached several definite conclusions about uniforms. It is generally agreed that cotton is the best material for uniforms. It stands up better, can be laundered economically and easily, wears a long time and looks good for the length of its lifetime.

A standard color uniform, brightened up by a distinctive company emblem, is generally the best and most practical. It doesn't compete with your company emblem and naturally focuses attention on the spot where your company's products are advertised.

Uniforms should be wash-tested before they are adopted. "Fruit salad" features should be avoided. They look fine at first but are often impractical, cause problems in laundering, and their over-all effect is nearly always detrimental in the long run.

For those interested in adopting a uniform or changing the uniform their employees wear, the Institute of Industrial Laundries maintains a free consulting service. Hundreds of companies have used it. It is made available without charge or obligation of any kind and expert, practical men in the field consult with responsible company officials.

How to Die-Cut Pressure-Sensitive Face-Split Labels

Some practical tips for experienced pressmen tell how to handle the problems caused by variations in the pressure of the dies

by **WILLIAM PETTIT**
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From time to time, printers turn to our company with questions about the technique of die-cutting pressure-sensitive adhesive stocks. The following article outlines some of the principal factors involved. Since complete cut-through presents no more problems with pressure-sensitives than with other types of stock, only "facesplits," or the partial die-cutting of pressure-sensitives down to the backing, will be covered.

According to die-cutting specialists, the main problem in die-cutting is obtaining a uniform cut. In certain areas of the piece, the die may cut all the way through, in others it may not cut enough. This means that great care must be taken with make-ready. The time involved in preparing the make-ready is in direct proportion to the skill of the pressman, condition of the press, and type of press.

The tolerances which must be maintained in die-cutting pressure-sensitives are very fine. A slight variance — as little as five thousandths of an inch — cause a cut-through of the backing sheet.

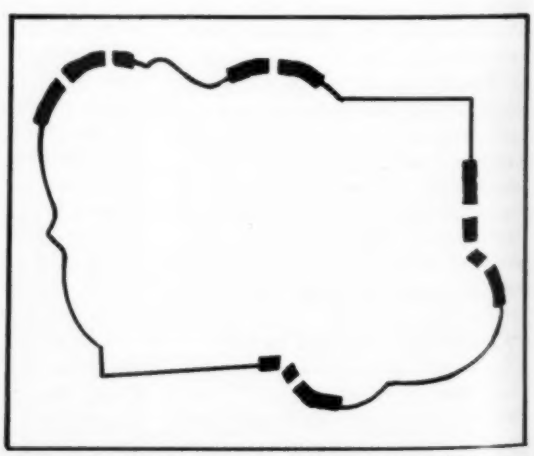
Variation in die pressure can be regulated by co-ordinating the pressure of the press to one or more thicknesses of masking tape placed at points on the steel cutting plate where the die is not cutting through sufficiently. A good pressman will always place this tape on the under surface of the plate. Only at the end of the run when a heavier "kiss", or minor adjustments, may be needed should the tape be placed on the top surface of the plate.

The average job printer running a pressure-sensitive face-split job in his own shop, should, if possible, use a platen press which is in good shape. A more fixed impression will be maintained on a flat-bed press.

A cylinder press should only be used on runs with small area cuts. The smaller the cylinder, the better the chances of avoiding slippage and variation of the cutting depth. The presses used have a lot to do with the efficiency of the die-cutting job. Certain presses are available on which impressions can be controlled to fine tolerances while running. Such standard makes of presses as Miehle, New Era and Heidleberg will all turn out good die-cutting jobs.

For the average printer, the problem in die-cutting facesplits is in not having a man for the set-up. The run is more costly, because the set-up time is greater than normal print runs. In addition, his man cannot leave the press during the run to take care of other jobs. He must stay with the face-splitting job to insure that uniformity of cut is maintained throughout the run. A printer may find that in more involved jobs — long runs with quite a few die-cut pieces per sheet — it might be more practical and economical to farm the job out to a reputable die-cutter.

Printed surface of die-cut piece showing outline of the die-cut design. The dotted lines indicate areas where masking tape build-up is required on cutting plate.



Underneath surface of press cutting plate. Black areas show where masking tape is applied. Outline of the design merely indicates the relative position of the tape.

In setting up the press for a die-cut run, the pressman calipers stacks to determine average sheet thickness. He then bases his make-ready on this sheet thickness.

It is not sufficient, however, to base a complete run on the initial make-ready. The pressman must adjust tape application in his make-ready by trial and error after running through a few sheets — adding or removing tape where necessary to obtain uniformity of cut. After approximately 1000 or 1500 pieces have been run, it often becomes necessary to stop again to re-adjust the press.

The tolerances of the steel rule dies are also important. The printer should obtain his dies from a reputable diemaker. The bevel on the dies should be such that it exposes a minimum surface to which the adhesive can adhere. Usually, according to some die-makers, a center face (two-sided bevel) die will prove the most practical.

The die used by most leading label printers has a steel rule with an average Rockwell hardness measurement of 70. To cut Mylar, a harder steel rule with a long bevel should be used.

In assessing a pressure-sensitive face-split job, a printer should ask the following questions:

(1) How large is the sheet?

(2) How many die-cut pieces are on the sheet?

(3) How many sheets are involved?

About the Author . . .

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By MILTON H. KEMP

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P-S Tape Seals Plastic Tent Against Weather

An adhesive tape originally manufactured to seal sheet metal pipes has found an ingenious application in the construction of a polyethylene camping tent.

Built by T. M. Ferguson, St. Catherines, Ont., Can., the tent is made of eight-mil plastic sheets, ten feet wide. Since an earlier attempt in which the plastic had been sewn together did not hold up against adverse weather conditions, Ferguson wanted to replace the sewing method with a strong, lightweight, waterproof sealing material.

Recommends Plastic Tape

A letter to Arno Adhesive Tapes, Inc., brought the recommendation of C-504 Coated Cloth Tape, a pressure-sensitive, plastic-coated product with a high tack, reclaimed rubber base. Only .013 inches thick, the tape is designed for top resistance to aging and weathering.

Ferguson joined the corners of the tent and sealed them with tape on both the inside and outside. The tape was carried along the seams right over the top edge and built up in several layers for the tent peak. One thickness of tape all around the bottom of the tent and the door flap provided protection against accidents and wear.

To provide for air vents, the tape was also used for sealing in fiberglass screening about six feet from the ground on both sides of the tent. Apertures for the screening were made by cutting the two sides and the bottom only; this meant that the top of the flap was attached to the tent and could be let down to seal off the vent when necessary. The screening was attached from the inside and the tape overlapped so that when the flap is closed there is at least ¾ of an inch of tape behind it.

Ferguson's tent was made to be pitched with a center pole, by a rope strung between trees or with an outside tripod. To do this he cut a ½-inch hole at the peak. The several layers of tape at this point reinforce the hole.

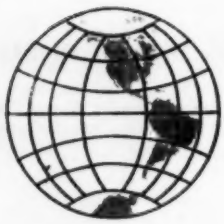
Below the hole, inside the tent, Ferguson placed half of a child's rubber ball. A piece of ½-inch rope was reeved through the hole to form a loop outside the tent and a knot inside the tent. The other half of the ball was then placed over the loop on the outside.

This arrangement permits the pole to be braced without tearing the tent.

Rows of Grommets

Corner bracing is done with loops of rope strung through about two feet up the tent. Along all the sides, almost at the bottom, are rows of grommets through which a line can be laced for pegging down.

Since all sides are the same and the bottom is a square, the tent can be neatly folded into a tidy bundle that fits into any camp pack. The completed tent weighs slightly over seven pounds and can accommodate four people.



NEWS of the ADHESIVES WORLD

Adhesives in Building Discussed at B. R. I. Spring Conference

"Adhesives and Sealants in Building" was the subject of the 1961 Spring Conferences of the Building Research Institute, held on May 16 to 18 at the Shoreham Hotel, Washington, D.C. The conferences featured a session on "Pressure-Sensitive Tapes for Buildings," with Charles O. Pike (Shuford Mills) acting as chairman, and a session on "Selection and Field Application of Adhesives," with D. Kenneth Sargent (Syracuse University) as chairman. George J. Schulte (Minnesota Mining) served as chairman of the Planning Committee. Approximately 450 persons attended.

A portion of the group attending the Building Research Institute conference on Adhesives and Sealants in Building.

Papers presented at the first session were: "Applications of Pressure-Sensitive Tapes in the Building Industry," by Donald A. Wallace (Johnson & Johnson), and "Recent Field History of Pressure Sensitive Tapes for Sealing Applications," by Paul H. Wilson (Minnesota Mining). The following papers were read at the second sesssion: "Adhesives for Ceramic, Plastic and Metal Tile," by Alex O'Hare (R & D Miracle Adhesives); "Adhesives for Wallboard," by Sidney Lauren (Johns-Manville); "Adhesives for Resilient Floor Coverings," by Carl L. Carlson (Armstrong Cork); "Selection and Application of Adhesives for Plastic Laminates," by George J. Schulte (Minnesota Mining); "Adhesives for Acoustical Tile," by Francis S. Branin (ASCO Products); "Adhesives for Insulation," by Wayne P. Ellis (Benjamin Foster); and "Adhesives for New Field Applications," by Jerome L. Been (Rubber & Asbestos).

Tape Applications

Mr. Wallace, in his paper on "Applications of Pressure-Sensitive Tapes in the Building Industry," pointed out that pressure-sensitive tape is a fast and convenient means of affixing in position, either permanently or temporarily, the various type backing materials from which tapes are manufactured. Backing materials such as plastic films, cloth fabric, paper and metal foils give each individual tape product its primary characteristics such as moisture, chemical and temperature resistance, electrical insulating qualities, conformability and others. This wide selection of pressure-sensitive tapes is used in the building industry as a means of sealing, water-proofing, electrically insulating, holding and protecting. The speaker went on to outline some of the important tape applications in the building industry.

Mr. Wilson, speaking on "Recent Field History of Pressure-Sensitive Tapes in the Building Industry," explained that long-aging tapes were developed primarily in response to a desire for a new answer to the joint problems in curtain wall and other structures. The principal advantage of a tape seal is that it permits a much wider range of movement between adjacent panels, while still maintaining a weather-proof seal, than is possible with conventional sealants. The speaker discussed two completely different ba-

sic backings for tape seals—plastic and metal—illustrating his talk with slides showing how various types of pressure-sensitive tapes were used in specific buildings.

In his paper on "Adhesives for Ceramic, Plastic and Metal Tile," Mr. O'Hare stated that there are three types of widely sold adhesives: resin base, latex base, and rubber-resin base adhesives. The straight resin base adhesives lack water resistance, he declared, and many current brands of this material are unsuitable for ceramic tile installations in areas subject to moisture. Generally they fail to conform to industry standards. Lower price, easy spreadability, and simple soap and water cleaning of hands and tools are reasons for their wide use in low-cost work. Latex base adhesives were the second type of ceramic tile adhesives to be considered. The one-part materials develop high initial strengths, and are considered satisfactory products for dry areas. Wet strengths fall considerably, however, and it is for this reason that several of these adhesives are right on the edge when it comes to meeting standards.

Panel members for the BRI session on Pressure-Sensitive Tapes for Buildings. Left to right: Charles O. Pike (Shuford Mills), session chairman; Paul H. Wilson (Minnesota Mining) and Donald A. Wallace (Permacel), speakers.

Rubber-Resin Base Type

The third and most available type of "thin-set" tile adhesive, Mr. O'Hare continued, is the rubber-resin base composition. Materials of this formulation are basically similar to the original material tested at Rutgers University in 1937. This adhesive consisted of reclaimed rubber, resins, and fillers, in combination with a solvent which gave a degree of fluidity that allowed easy spreading. Because of water resistance, flexibility, and tenacious bond strengths, rubber-resin base adhesives have earned a good reputation and have been widely accepted by owners, architects, and tile contractors. Naturally, the speaker stated, improvements in rubbers, resins, fillers and solvent mixes as well as manufacturing methods have developed a far better product through both field and laboratory experience.

Mr. Lauren, discussing "Adhesives for Wallboard," remarked that although variations in the treatment of exposed surfaces — with coatings, laminates and physical textures—yield great differences in decorative appearance, the principal types of wallboards and panels now in common use may be classified in the following five categories: gypsum wallboards, the universal "dry-wall" material; plywoods; hardboards and semi-hardboards; asbestos-cement board; and insulating board (low density wood fiber board).

Adhesives for Wallboards

Principal types of adhesives for wallboard installations, the speaker continued, are mastics, contact cements and "white glues." Mastics are high solids, filled adhesives based on asphalt-rubber or lighter-colored reclaimed rubber-resin compositions. Contact cements are low solids, but viscous, fluid adhesives based on modified neoprene compositions. They have a characteristic rubbery stringiness and contain powerful, fast evaporating solvents of very low flash point. White glues are emulsions of polyvinyl acetate with modifying plasticizers. These are moderately viscous liquids and are not recommended for use where water resistance is necessary, Mr. Lauren declared, or even under condition of high and prolonged humidity (as in bathrooms and shower rooms).

Floor Covering Adhesives

Mr. Carlson, in his paper on "Adhesives for Resilient Floor Coverings," stated that prior to World War II there were four basic types of resilient flooring products on the market: linoleum, asphalt tile, rubber tile, and cork tile. With the exception of asphalt tile, all were intended for use on suspended subfloors only. In the years following World War II, however, the new elastomeric and resinous materials, chiefly vinyl, began to find use in resilient flooring products. The basic types of resilient flooring adhesives currently available can be classified as follows: sulfite liquor based adhesives; asphaltic adhesives-emulsion and cut-back; waterproof cement (solvent type, for suspended floors only); latex adhesives (for on- and below-grade flooring); and chemical setting adhesives—latex and epoxy.

Linoleum paste, the speaker explained, is so named because since its inception it has been associated

with installation of linoleum. Today, however, it is used not only to install linoleum but also rubber tile, certain vinyls, cork tile, lining felt, etc. Asphaltic adhesives have been used for many years for the installation of asphalt tile and, since its introduction several years ago, for the installation of vinyl asbestos tile as well. Waterproof adhesives were originally intended almost entirely as substitutes for linoleum paste on suspended subfloor installations where surface spillage of water was likely to occur. The dried film of these adhesives is usually quite hard and, while insoluble in water, the adhesives are likely to be attacked readily by alkaline water. For this reason they are unsuitable for use on- or below-grade.

Latex Adhesives Used

Latex adhesives which do not require mixing are currently being used to install rubber tile and vinyl tile, as well as certain types of sheet floorings on grade level and below-grade subfloors. In addition, they are finding use on suspended subfloors as well as where the use of a waterproof adhesive is indicated. Epoxy adhesives are the latest type to receive attention as flooring adhesives, Mr. Carlson concluded. Whether or not they are going to play a significant part in the installation of resilient flooring cannot be definitely predicted at this point. Performance-wise they are generally good but, from an application standpoint, they have several draw-backs, such as need for mixing, difficulty in spreading, excessive slippage in tile goods, possible sensitivity in some individuals, and high cost.

Bonding Plastic Materials

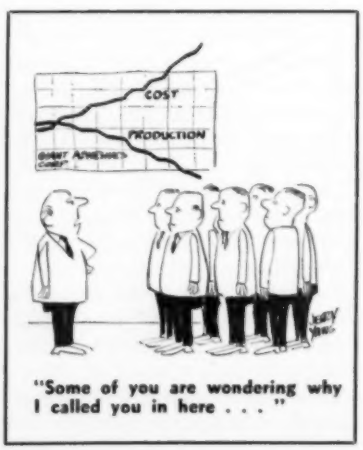
In his paper on "Selection and Application of Adhesives for Plastic Laminates," Mr. Schulte defined a plastic laminate as several sheets of plastic which are bonded together, with the surface sheet usually being a melamine resin for its clarity and durability, and the backing sheet being paper impregnated with phenolic type plastic formed under high pressure and temperature.

There are more than a half dozen different types of adhesives used for bonding various plastic surfacing materials, he declared. These are of two general types: thermoplastic—those which can be repeatedly softened with application of heat — and thermosetting — those which chemically cure to a state from which they will not soften on application of heat. The popular contact bond adhesives are primarily synthetic rubber cements with either a volatile lacquer type solvent base or a water base. They give an instantaneous bond of quite high strength without the use of clamps or presses, and are water-proof.

Thermoplastic Adhesives

Other thermoplastic adhesives, such as the white glues and caseins are used successfully. The curing urea resin type adhesives such as the urea-formaldehydes are used in the shop because they require that a press be used to hold them at room temperature for a period of time (usually overnight) before setting occurs. Resorcinol glues, Mr. Schulte declared, are the "Cadillacs" of the trade. They are the strongest, most waterproof and heat resistant of the adhesives, but are very expensive and require clamping or pressing as do the ureas. The speaker concluded his talk with a discussion of methods of application of each of these adhesives, with emphasis upon the precautions needed to assure a satisfactory job.

In his talk on "Adhesives for Acoustical Tile," Mr. Branin declared that acoustical adhesive is essentially nonstructural and is used mostly to support acoustical tile in cleavage. However, as with a wall installation, shear is also involved. Because it has been found in practice that the uneveness of the substrate dictates the necessity for its use, and because it also serves as a leveling or bedding compound — it therefore becomes a construction material as well. Application of the adhesive to both adherent and substrate requires positive wetting in each instance of contact, the speaker explained. This contact, once made and set, should not be disturbed through movement contrary to cleavage stress. Acoustical adhesive is also required to maintain a tension adhesion of not less than one half pound per square foot for a long period of time.



"Some of you are wondering why I called you in here . . . "

Proper Formulation

If the adhesive is properly formulated, Mr. Branin stated, it will not throw off its plasticizer in the aging process; ceiling temperatures over a long period of time will not dry out the adhesive or cause it to harden or shrink or, as a result, break the bonding points. An installation holding well over a long period of time, where there has been no evidence of corners letting down, speaks well for the wetting and workmanship which went into the initial placement of the tile.

Bonding Insulation Materials

Mr. Ellis, speaking on "Adhesives for Thermal Insulation," explained that, in general, adhesives are used for bonding insulation materials to structures, piping, ducts, tanks, and vessels; for preassembly of portable insulation units, such as pipe fittings and valves; for attaching jackets or other facing materials to insulation; and for the attachment, sizing and sealing of fabric covering on insulation. Uses of adhesives fall into three main categories: insulation lagging, insulation bonding, and insulation facing and jacketing.

The speaker went on to describe the most suitable types of adhesives for these uses. For insulation lagging over all types of insulation, the most popular, serviceable and economical adhesives are compounded

from water emulsions of polyvinyl acetate. The use of PVA adhesives for both lap sealing and sizing of canvas jackets provides a non-flammable finish which is strong, tight, light in color, sanitary, and an ideal base for painting or color coding. Insulation bonding on roofs is often done with hot asphalt. Asphalt emulsion or solution adhesives are commonly used for attaching fibrous glass, mineral wool, corkboard and cellular plastic insulation materials in both ceiling and sidewall construction.

High Temperature Adhesives

Where high temperature adhesive is specified, epoxy or phenolic modified elastomer adhesives should be used. For insulating cold or dual temperature piping and air-conditioning ducts, the insulation usually is supplied with a vapor barrier jacket, and is applied to the pipe by cementing the flap of the longitudinal joint. Bands of the jacket material are cemented over the butt joints. For this purpose, the resin-rubber solvent type adhesives are the most popular and economical.

The final speaker, Mr. Been, speaking on the topic "Adhesives for New Field Applications," pointed out that there are recently-developed two-part, room temperature setting, long pot life, filled, thixotropic, void-filling, non-inflammable, 100 per cent reactive paste adhesives available to the building field. These adhesives are based on organic resin ingredients.

Organic Chemical Systems

There are many organic chemical systems to choose from in this relatively new adhesive technology, he stated — epoxy, polysulfied, phenolic, furane, polyurethane, etc., including combinations and mixtures of these types. Their properties as adhesives are in many ways far superior to those of Portland cement mortar. Their application characteristics are quite similar — that is, they have to be proportioned, and mixed with attention to ratio and temperature, used within a known limited time, and applied with somewhat specialized tools by fairly skilled labor.

Mr. Been declared that the order of magnitude of strengths of these adhesives is far greater than the inherent strength of many of the components of standard building, particularly wood and inorganic components such as bricks and concrete blocks. Where these materials have to be bonded, there is plenty of leeway for modifying and extending the inherently too strong organic adhesive in the interest of economy or of special application characteristics. However, their ability to bond to glass, metal and other non-porous and basically stronger materials, stimulates their use in applications where the full range of available strength characteristics of these adhesives is required.

Staley Opens Research Center

A. E. Staley Manufacturing Co., Decatur, Ill., has opened a new 108,000 square foot research center, which will be devoted to developing new products for consumers and for the adhesives, food, paper, textile, building materials, and other industries. The new center is expected to stimulate further progress in research on new processes, plants, and products, particularly in product developments from the Staley starch fractionation process, which reportedly opens up a new area of corn starch applications.

Construction of the research center began in 1959. The building consists of three wings occupying nearly two acres. A four-story central wing houses 138 fully-equipped laboratory units. A three-story south wing houses administrative offices and a technical library. In the two-story north wing, there is a cafeteria seating 150 persons, and an auditorium for 225 people, with on-stage provisions for laboratory demonstrations.

Facilities include four "special climate" rooms, equipped to maintain specified temperature and humidity levels for experimental work in which atmospheric conditions are critical. Other special facilities are provided for laboratory supplies, microscopy, spectroscopy, photography, glass blowing, equipment making, water distillation and distribution, shipping, sample storage, and care of glassware.

Scientific equipment includes a multi-purpose pilot paper coating machine, capable of drying a 10-pound per-side coating on a 20-inch-wide sheet at speeds up to 2,000 feet per minute, a three-roll B. F. Perkins supercalender, equipped for continuous calendering, a precision trailing blade coater for experimental applications, a Concora medium tester for wet end additives, a Hinde and Dauch crush tester, an electron microscope capable of 1½ million diameter magnifications, a Scott internal bond tester, and several types of viscometers.

ADM Names Three

Archer-Daniels-Midland Co. has appointed Dale W. Laudenslager as manager of its new Peoria Chemical Center, Peoria, Ill., and has assigned Herbert F. Davidson and Orlando Graziani to new posts. Mr. Davidson has been named operations coordinator for the company's chemical group plants at Los Angeles, Calif., Valley Park, Mo., Pensacola, Fla., Newark and Elizabeth, N.J., Ashtabula, Ohio, Wyandotte, Mich., and the chemical center at Peoria. Mr. Graziani has been named operations engineer for the entire chemical group, with responsibility for process studies and other engineering assignments.

Mr. Laudenslager graduated from Adrian College with a degree in chemistry. He joined ADM in 1942 as a chemist at the Wyandotte chemical plant. He later became manager of the Elizabeth chemical plant and the Buffalo, N.Y. linseed plant. In 1960, after serving for a year as production manager of the Formula Feed Division, he was named production manager for the industrial chemical plants at Elizabeth, Wyandotte, and Ashtabula.

Mr. Davidson attended the University of Minnesota and joined ADM in 1943 as a chemist in the Minneapolis research laboratory. Two years later he was promoted to manager of the Los Angeles oil refinery. He returned to Minneapolis in 1952 as assistant to the general superintendent of refineries, and in 1955 became production manager for the linseed oil and resin plants. In 1957 he was named coordinator for all resin plants, and in 1960 became production manager for the Resin Division. Recently, he has been coordinator of production operations for the chemical group.

Mr. Graziani is a graduate of Lehigh University with a degree in chemical engineering. He started with the company in 1939 as chief chemist at the Wyandotte plant, and became plant manager there in 1950. In 1960 he was named assistant project leader for the development of process engineering for the new Peoria chemical center. He also has served in an advisory and consulting capacity for some of ADM's foreign affiliates.

R. S. Temple

Fills Valchem Post

Valchem, the Chemical Division of United Merchants & Manufacturers, Inc., New York, N.Y., has appointed Robert S. Temple to the newly-created position of sales manager for plastics. Initially, he will be responsible for polyester resin sales. Prior to joining Valchem, Mr. Temple was associated with Union Carbide Corp., Allied Chemical Co., and the Naugatuck Chemical Division of U. S. Rubber Co. He also served as the head of the Plastics Section, Navy Department, Bureau of Aeronautics, as well as in the Research & Development Office of the Secretary of Defense.

FBRAM Technical Panel

The Technical Panel of the recently-formed Sealant Manufacturers' Conference of the Federation of British Rubber and Allied Manufacturers, in a meeting on March 22 in London, England, began to draw up performance standards for rubber-based sealing compounds. It also started to work on a code of practice for their application in the building, ship-building and other industries. Dr. Wallace Rubin (Kelseal) was elected chairman of the Technical Panel, and L. E. Puddefoot (B. B. Chemical) was elected vice-chairman. Other members of the Technical Panel are: Dr. J. Bowler-Reed (Expandite), L. W. Cutler (British Paints), Dr. B. S. Jackson (Evomastics), G. H. Marsh (Minnesota Mining), and A. G. Storey (T. & W. Farmiloe).

G-E Silicone Additives

The first two controlled release silicone additives available to industry on a commercial basis are being offered by the Silicone Products Department of the General Electric Co., Waterford, N.Y. The controlled release additives, SS-4023 and SS-4025, are among seven new silicone products designed for the paper industry. The additives reportedly make it possible to produce silicone coated paper commercially with the specific degree of release desired. By using these materials in conjunction with G-E silicone release coatings SS-4001 and SS-4026, it is possible to achieve controlled release, particularly as required in the manufacture of pressure-sensitive tapes and labels. According to the company, by proper application, release coatings are obtained which provide stable-controlled release for extended period of time.

The new silicone release agents are SM-2016, a fast-curing silicone emulsion, SM-2026, a silicone emulsion for food-grade applications, SS-4026, a silicone solution offering improved anchorage to the sheet, SS-4034, a non-inflammable silicone solution, and DF-1040, a 100 per cent silicone fluid for food-grade application.

National Fibre Officers

Charles H. Campbell, vice-president of sales for Sonoco Products Co., has been elected president of National Fibre Can and Tube Association, New York, N.Y. Vice-presidents elected to serve during the coming year are: E. D. Bangs (Thames River Tube), eastern area; George R. Browner (Mean Board Sales), southern area; and C. W. Mullery (Mullery Paper Packages), western area. J. J. Nelligan, vice-president and general manager of Stone Paper Tube Co., was elected treasurer, and William E. Hughes was appointed managing director.

Changes Name to FMC

Stockholders of the Food Machinery & Chemical Corp., San Jose, Calif., have approved the changing of the company name to FMC Corp. The new name will be effective on July 1, 1961.

DuPont Develops Baymal Alumina

Baymal colloidal alumina, a versatile aluminum oxide powder said to be suitable for a wide variety of uses, has been developed by the Industrial and Biochemicals Department of E. I. du Pont de Nemours & Co., Wilmington, Del. According to DuPont, Baymal is so versatile that in one form it is hard enough to machine steel or cut glass, while in another form it can be used to improve the smoothness of a skin lotion. When Baymal colloidal alumina powder is added to water and allowed to dry, either a supported film, a bonded structure, or an alumina gel can result.

In the first case, if a thin layer of sol is dried, the small fibrils lie flat and interlace to form a film. If such a film is formed in the presence of fibers, such as glass fibers or asbestos fibers, which are much coarser than fibrils of Baymal, this film will form at the junction points between the larger fibers, giving a bonding or adhesive action. Research chemists at DuPont believe this to be the basic mechanism for the use of Baymal as a high-temperature, inorganic adhesive.

Baymal is reported to be an especially effective bonding agent for particulate inorganic materials such as clays, carbonates, silica, ground mica, etc., and fibrous glass, aluminosilicate fibers, and asbestos. It may be used as an internal bonding agent, such as in the formation of asbestos or glass paper, using standard paper-making techniques. It may also be used as a stiffening and strengthening agent by impregnation of performed papers, felts or batts of fibrous materials. Adhesive properties may also be used to advantage, according to DuPont, in laminating inorganic papers of felts. Extension of this technique may be employed to prepare bonded bricks or other formed shapes of controllable density and porosity.

• General Electric Co., Waterford, N.Y., has appointed the Smooth-On Manufacturing Co., Jersey City, N.J., as distributor of its RTV silicone rubber to the tooling trade. The distribution territory is the East Coast, south of New England.

L. L. Redshaw

Names U B S President

Lincoln L. Redshaw has been appointed president of the U B S Chemical Co., Cambridge, Mass., succeeding Paul W. Atwood, who has retired. Mr. Redshaw received his degree in chemistry from Tufts University, and has studied at the Harvard Graduate School of Business Administration. He has been with U B S for 24 years, starting with the old Union Bay State Co. in 1937, after graduation. He has served in various management posts, including technical, production, and purchasing functions. He was elected vice-president in 1946, and became manager of sales to the shoe industry in 1954. He has headed manufatcuring and personnel at U B S since 1955, and has been instrumental in the company's foreign operations. Mr. Redshaw is also a director of Staperm, a joint venture affiliate set up for the sale and distribution of polymer emulsions in the United Kingdom.

Armstrong Expanding

Armstrong Products Co., Warsaw, Ind., reports that its $100,000 expansion program, including a 5,000 square foot factory building which will double production capacity, is nearing completion. The new factory building will house production facilities for the epoxy resin adhesives and coating materials produced by the company, as well as equipment for their application, made and marketed by an affiliate company, Armstrong Resins, Inc.

Adhesive Session Held At ASME Conference

A session on "Adhesives — for Metal Bonding" was a feature of the 6th Annual Design Engineering Conference and Show of the American Society of Mechanical Engineers, held on May 22 to 25 at Cobo Hall, Detroit, Mich. Two papers were presented at this session: "Elastometric Adhesives — Industry's New Tool," by W. C. O'Leary (Minnesota Mining), and "Factors in Joint Design Using Adhesives for Metal Bonding," by Kenneth F. Charter and Harry R. Butzlaff (A. O. Smith). Nicholas J. DeLollis (Sandia Corp.) and Sumner B. Twiss (Cycleweld) acted as co-chairmen.

Mr. O'Leary discussed adhesives which are basically elastomeric in character, including an almost infinite variety of products obtainable from natural, reclaimed and synthetic rubbers in combination with natural and synthetic resins, and with a variety of solvents and diluents. For the most part, this excludes the glues derived from fish, animal and blood sources, and resorcinol, phenolic and urea glues which provide essentially rigid bonds, and the gluepastes derived from flour, starch, dextrines and related materials.

Mr. Butzlaff analyzed the factors leading to the selection of adhesives for bonding metal, and the limitations of these adhesives. He explained that the factors which need to be known in most problems of design are frequently different from those considered in designing with non-organic materials.

Acquires Plastic Products

Helene Curtis Industries, Inc., Chicago, Ill., has purchased the Plastic Products Co., Detroit, Mich., a company with sales of $2 to $3 million per year. Plastic Products is in the process of acquiring two other companies in the same field, Helene Curtis has announced, and when these mergers go into effect, Curtis will have a package with $8 to $9 million per year in sales. The acquisition of Plastic Products was for cash, the amount involved not being disclosed. No changes in the marketing or personnel setup are planned.

Gantrez Vinyl Resin

The first of a series of vinyl ether polymers and copolymers, to be sold under the newly-established trademark Gantrez, is available from the Commercial Development Department of the chemical group of General Aniline & Film Corp., New York, N.Y. The first entrant in the new product line is Gantrez An resin, a water-soluble copolymer of methyl vinyl ether and maleic anhydride (PVM/MA). Said to be useful in adhesive, coating, textile, soap, detergent, paper, leather, latex polymerization, cosmetic, oil production, photo-reproduction and other chemical processing and industrial applications, it is available in semi-commercial quantities in three specific viscosity ranges — low, medium and high.

The resin is a free-flowing, white powder, said to be water-soluble over the entire pH range. The company states that Gantrez An offers a number of advantages to the adhesive compounder as a component for remoistenable and pressure sensitive adhesives and heat set adhesives. Films of the resin are also reported to be highly polar and form strong bonds to glass, plastic, ceramics, leather, metal, cellulose, rubber and painted surfaces.

Reichhold in Puerto Rico

Reichhold Chemicals, Inc., White Plains, N.Y., has established Reichhold Chemicals del Caribe, Inc., Santurce, Puerto Rico, to manufacture synthetic resins and latex emulsions. The company is a joint venture of Reichhold Chemicals and Adolfo Vianova, Jr., a Puerto Rican industrialist. Initial capitalization of the company is $500,000 for plant and equipment. Output of the affiliate will be sold in Puerto Rico through C. Withington Co., located in Long Island City, N.Y., and in Santurce.

Glazol Opens Sealant Unit

A new factory devoted to the manufacture of polymer base sealants and glazing products has been opened in Calgary, Canada by Glazol Mfg., Ltd. The plant is reported to have cost approximately $50,000.

J. A. Bralley

Elected Vice-President

Dr. James A. Bralley has been elected vice-president of the Research and Development Division for the A. E. Staley Mfg. Co., Decatur, Ill. Dr. Bralley studied at the University of Virginia and received his doctorate there in 1941. He was a research chemist with the B. F. Goodrich Co. for five years, and was with the Rohm & Haas Co. for 10 years as senior chemist in charge of the process development laboratories. Dr. Bralley joined Staley in 1956 as director of research, headed the Chemical Research Department, and recently was named head of the Research and Development Division.

PRC Awarded Patent

A patent for polysulfide compositions and cure, said to be the second ever issued by the U.S. Patent Office for a compounded polysulfide sealant, has been awarded to Products Research Co., Burbank, Calif. The first patent, issued in 1957, is also held by Products Research and is for a basic polysulfide based sealant used in integral fuel tanks of military and commercial jet and piston aircraft. The new patent was issued to cover improvements to the original product. The company states that the exceptional fuel resistance properties of the sealant, PR-1422, have been a significant element in aviation development, since they allow weight reduction and permit greater design flexibility through use of integral fuel tanks.

New Butyl Rubber

Esso Research & Engineering Co., Linden, N.J., has developed a new type of butyl synthetic rubber believed to be applicable in advanced construction designs and wherever low-cost, long-lasting characteristics are needed. It is recommended by the company for use in curtain walls, utilizing metal frameworks from which panels are hung to form walls. The new butyl rubber is said to form a weatherproof skin around the building, acting as a sealing system along the edges of the glass and panels. An important feature of the rubber is its ozone resistance, said to be greater than that of other commercial general purpose rubbers. According to Esso Research, other applications include automotive weather stripping and seals, electrical insulation, extruded and molded sponge, and other molded goods, such as hose and tubing. The product is being marketed in sample quantities by the Enjay Chemical Co., New York, N.Y.

Ciba Offers New Resin

Araldite DP-310, a low viscosity, modified epoxy resin produced through modification with a reactive diluent is now available from Ciba Products Corp., Fair Lawn, N.J. Several advantages for the new liquid resin are claimed, including pleasant low odor, less skin sensitizing, lower vapor pressure, and higher flexural strengths. Araldite DP-310 is recommended by Ciba for use in adhesives, solventless coatings, electrical encapsulating compounds, flooring, laminating, and tooling compounds where low viscosity is required for best impregnation or maximum filler loading.

U. S. Borax Expands

United States Borax & Chemical Corp. has begun construction to increase the capacity of several production units at its Boron, Calif., installation. The expansion is designed to raise production of both primary and specialized borax products, but there will be an immediate benefit with an increase in the supply of anhydrous products upon completion of additional fusing facilities.

ASTM D-14 Holds Meeting

At a meeting of ASTM Committee D-14 on Adhesives, held on March 16 and 17 in Washington, D.C., a Subcommittee on Special Adhesives was formed to work on packaging adhesives, shoe adhesives, optical adhesives, and general-purpose adhesives.

The main committee reported that work on wood adhesive test methods is developing new methods for testing lumber adhesives, veneer adhesives, pulp and particle board binders, and adhesives for bonding wood to other materials. A study of dimensional orientation of wood grain angles for the cross-lap shear test was presented. This study will be used as a basis for revisions of the sample preparation in Method D-905.

Several metal adhesives methods are being finalized in subcommittees. They are: strength properties of adhesives in shear by compression loading; strength properties of adhesives in shear by tension loading in the temperature range 600° to 1,500°F.; creep properties of adhesives in tensile shear in the temperature range of —67° to 500° F.; and preparation of metal surfaces for adhesive bonding.

The committee also announced that a recommended practice for the preparation of surfaces of plastics for adhesive bonding is being developed. Existing Committee D-14 methods that could be made applicable to plastics adhesives testing are being reviewed. In addition, a new method of determining the tensile strength of adhesives by the use of rod and bar specimens is being developed. This method will be available as an alternate to Method D-897, which is an old-style approach to the determination of tensile properties. A recommended practice for the preparation of specimens for the bar and rod tests is also being developed.

Firm Name Changed

American Tape Co., Port Huron, Mich., has changed its name to the American Pres-Stix Tape Co. The change is part of an expansion program in which regional offices are being established throughout the country.

HERE'S WHAT WE'LL SAY IN OUR AD...THAT WE HAVE A WIDE VARIETY OF RESINS FOR ADHESIVES.
A WIDE CHOICE TO MEET OUR CUSTOMERS' VARYING NEEDS
VINYLS, PHENOLICS ...AND EPOXIES.
PRODUCED TO EXACTING QUALITY STANDARDS
OBTAINABLE EVERYWHERE!

SIMPLIFY *your* formulating problems by checking with us first. We can't guarantee the best adhesives (that depends on your formulating know-how). But, we *can* guarantee the best resins that over 50 years of plastics manufacturing experience can produce—and at no increase in cost. With a variety of top quality resins to choose from, you're well on your way to formulating a superior adhesive.

When you get in touch with Union Carbide Plastics Company, you can choose from a variety of vinyl, phenolic and epoxy resins, all from one source. So simplify your formulating problems; write, stating your requirements, to Dept. JN-1F, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trademarks of Union Carbide Corporation.

Resin Latex Developed

The Resin Division of National Starch & Chemical Corp., New York, N.Y., has developed a self-cross-linking resin latex said to offer unique formulating and end-property advantages as a binder for a wide range of applications. The new vinyl-acrylic copolymer, called X-Link 2833, is reported to be capable of cross-linking without the addition of thermosetting resins, to form unusually strong and flexible films resistant to water, solvents and creep. The company states that use of the latex eliminates problems of stability, odor, compatibility, and high curing temperatures usually associated with combinations of thermosetting and thermoplastic resins. Suggested applications for X-Link 2833 include adhesives, wallpaper coverings, paper saturation, vinyl organosol tie coats, non-woven fabrics, awning coatings, and textile finishes.

Flame-Retardant Epoxy

A new flame-retardant epoxy resin for hot-melt castings and dry lay-up laminating systems is available from Union Carbide Plastics Co., New York, N.Y. When combined with aromatic amine or anhydrine hardeners, the epoxy, called ERL-0625, is reported to form cured systems with excellent physical, electrical, and chemical resistance properties resembling those of conventional diglycidyl ether of bisphenol-A epoxies. In addition, ERL-0625 passes the ASTM D-635, 30-second ignition Flammability Test, the company reports, with certain laminates proving to be self-extinguishing within four to seven seconds. Semi-solid at room temperature, it becomes a pourable liquid when warmed to about 130°F. for casting systems, and to 150°-155°F. for laminating systems.

M-P Elects Bookshester

David Bookshester, formerly sales manager of the Adhesives Division, has been elected vice-president of adhesives sales for Morningstar-Paisley, Inc., New York, N.Y. His new responsibilities will include the over-all marketing of adhesives and related chemical products.

R. B. Waters

Named Representative

Schenectady Varnish Co., Schenectady, N.Y., has appointed Robert B. Waters as technical sales representative in the greater Chicago area. He will be responsible for technical sales and service of the company's complete line of industrial resins to the adhesive, rubber, brake lining, printing ink, paint, foundry, and paper industries. Mr. Waters is a graduate of the University of Michigan with a B.S. degree in chemical engineering. Before joining Schenectady Varnish, he was vice-President of New Wrinkle, Inc., and prior to that, district manager for the Bakelite Division of Union Carbide Co. He has had over 14 years of sales experience with resins, plastics, and coatings.

NPBMA Elects Officers

At the annual meeting of the National Paper Box Manufacturers Association held on May 6 in Washington, D.C., the following officers were elected: *President,* Bill Price (Carolina Paper Box); *Vice-president,* Bertram I. Gordon (L. Gordon & Son); *Treasurer,* G. W. Lane (Packaging Corp. of America); and *Executive Secretary,* Norman T. Baldwin. Past president Wallace Ungemach (Wallace Paper Box) was elected for a one-year term as director ex-officio. Others elected to the board of directors are: Eric G. Ohstrom (Paul T. Freund); E. M. Donnelly (Palmetto Paper Box); and Heinz H. Loeffler (Exeter Paper).

Marketing Polectron

Antara Chemicals, a division of General Aniline & Film Corp., New York, N.Y., has developed a new series of water-emulsion copolymers of vinylpyrrolidone, marking the company's first entry into water-emulsion polymers. The emulsion copolymers will be available at first in development quantities, and will be marketed under the registered trademark Polectron. The first three products have been designated Polectron 130, Polectron 430, and Polectron 450. Some of the applications will be in bonding diverse materials to each other, in textile coatings, paper coatings, and glass fiber sizes. The copolymers can also be used as surface coatings, particularly as metal primers and top coatings for wood, as acid-stable detergent opacifiers, and as aerosol starch emulsions.

Enjay Offers Butyl Latex

Butyl rubber in latex form is now commercially available from Enjay Chemical Co., New York, N.Y. Designated Enjay Butyl Latex 80-21, the new material is a chemically stable emulsion of butyl rubber in water, containing approximately 55 per cent solids. According to Enjay, the latex can be compounded with pigments, fillers, thickeners and tackifiers. In addition, the company states, vulcanizates possessing the environmental resistance and low permeability to moisture and gases characteristic of butyl rubber can be prepared by curing 80-21 with sulfur, zinc oxide and other ultra-accelerators. Applications in which the new butyl is expected to find wide spread use include adhesives, textile dips and coatings, emulsion paints, roof coatings, and leather coatings.

Heyden Unit Opens

A 24-million-pound-per-year maleic anhydride unit, operated by the Heyden Chemical Division of the Heyden Newport Chemical Corp., has gone on stream at Fords, N.J. The facility was also designed to permit the production of related chemical intermediates for the plastics, synthetic resins, and other associated industries.

Plastic Bonded to Wood

A new process for bonding a clear, permanent plastic film to wood has been developed by U.S. Plywood Corp., Algoma, Wisc. The roll-laminating process utilizes a film called Videne, derived from polyester resins by Goodyear Tire & Rubber Co., and is being used to produce a new line of decorative plywood wall paneling and doors at U.S. Plywood's Algoma plant. Weldwood Permagard, the company's designation for panels and doors bearing the new protective surface, will be marketed in stock and custom sizes in practically all hardwood veneers. It is claimed that Permagard resists abrasion better than high pressure plastic laminates, and that stains such as dried paint, ink, bleaching agents and acids can be removed easily with water, common household detergent, or other standard solvents. The company states that the cost of the new paneling will be less than that of high pressure plastic laminates, and less than the cost of architectural grade wood paneling.

Paper Box Symposium

"Finding Hidden Profits in Set-Up Boxes — A Symposium" was the title of the discussion program sponsored by the National Paper Box Manufacturers Association and The Packaging Institute, held on March 30 at the Sheraton Hotel, Philadelphia, Penna. The program covered the use of set-up boxes in the packaging industry from economic and technical points of view. Walter P. Miller, past president of NPBMA, served as moderator. Speakers, representing both box manufacturers and users, were: Carmen M. Elliott (Eastman Kodak); Gerald W. France (Avon Products); Bertram I. Gordon (L. Gordon & Sons); Richard J. Hennessy (Lederle Laboratories); James Kiernan, Sr. (Kiernan-Hughes); Raymond J. Lowe (F. N. Burt), and Wallace Ungemach (Wallace Paper Box). Members of the Panel were: John W. Gray (Downingtown Paper); I. G. Nichol (Morningstar-Paisley); A. R. Schaefer (New Jersey Machine), and Charles J. Sweeney (Sinclair & Valentine).

DuPont Builds Resin Unit

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., will construct a new plant at Orange, Texas, for the production of high-pressure polyethylene, and a new product, Elvax vinyl resin, a copolymer of ethylene and vinyl acetate. The new unit will bring DuPont's over-all polyethylene capacity to nearly 400 million pounds. It will be erected at the company's Sabine River Works, and is slated for completion in the third quarter of 1962. Elvax vinyl resins are designed primarily for use as a wax additive, wax extended polymer, and adhesive base.

Buys Kleen-Stik Products

National Starch & Chemical Corp., New York, N.Y., has acquired the business and assets of Kleen-Stik Products, Inc., Chicago, Ill., in exchange for shares of National Starch common stock. Under the terms of the agreement, Kleen-Stik becomes a subsidiary of National Starch, but will continue to operate as a separate corporation under its present management.

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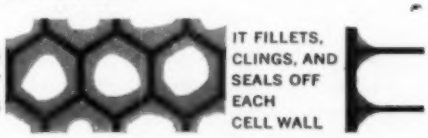

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names in the news

Malcolm G. Bourne, formerly with Koppers Co., Inc., has become market research analyst at AviSun Corp., Philadelphia, Penna.

Dr. Benjamin Borenstein has been named head of the product application laboratories for the Fine Chemicals Division of the Nopco Chemical Co., Newark, N.J. *F. Russell Gagnier* has been appointed sales representative in the Pacific Northwest for the Industrial Division.

Bruce S. Bernstein has joined the technical staff of Radiation Applications, Inc., New York, N.Y., as research chemist. *Richard Everett, Jr.* has joined the company as research engineer, and *Ernest G. Kramer* has joined the firm as research chemist.

C. Schoenfelder, formerly associated with Thiokol Chemical Corp., has joined the Sandia Corp., Livermore, Calif., as a chemist.

George W. Finlay has been appointed manager of the Wichita, Kansas, plant and Sales Division of Bemis Bro. Bag Co., succeeding *M. E. Ocker,* who has retired after more than 50 years with the company.

Clarence F. Klein, formerly director of package engineering and development at Lord Baltimore Press, has been named to the new post of director of machinery design and development at Packaging Corp. of America, Evanston, Ill. *Dr. Clinton W. Tasker,* formerly with the Film Division of American Viscose Corp., has joined the company's Grand Rapids, Mich., office as director of technical research and development.

William F. Dent has been promoted to the newly created position of regional sales manager at Crompton & Knowles Packaging Corp., Bellwood, Ill.

W. Warren Swenson has been appointed special representative in the metropolitan New York sales region for the Union Carbide Plastics Co.

Paul S. Hanway, managing director of the National Fibre Can and Tube Association, New York, N.Y., has retired after 28 years of service with the association.

Robert M. Mills, Jr., formerly associated with the General Electric Co., has joined A. E. Staley Mfg. Co., Decatur, Ill., as assistant training director.

Dr. Gordon J. Arquette, formerly supervisor of polymer research, has been appointed associate director of chemical research at the Central Research Laboratories of the Air Reduction Co., Inc., Murray Hill, N.J. *Dr. Morton W. Leeds,* formerly supervisor of organic chemical development and applications, has been promoted to assistant director of organic chemical development, and *Dr. Palmer W. Townsend,* formerly section head in the Chemical Engineering Division of Airco's Central Research Laboratories, has been promoted to assistant director of chemical engineering.

Paul W. Herrlinger, executive vice-president of Gummed Products Co., New York, N.Y., has resigned his post, but will continue to serve as a consultant.

Duane A. Jones has joined the staff of the central research laboratories of General Mills, Minneapolis, Minn., as project leader in the Steroid Research Department. *John S. Gracheck,* formerly associated with DuPont, has joined the sales staff of the company's Chemical Division.

Conrad G. Hurlimann has joined the Geigy Chemical Corp., Ardsley, N.Y., as vice-president and director. *Donald J. Harrington* has joined the Industrial Chemicals Division of the Enjay Co., Inc., New York, N.Y.

Dr. John C. Angus, formerly with the University of Michigan Research Institute, has joined the thermoelectric group at the Minnesota Mining & Mfg. Co., St. Paul, Minn.

C. D. Burns

Joins Adhesive Products

Adhesive Products Corp., New York, N.Y., has named C. D. Burns as southern sales manager. Mr. Burns will head the technical sales program in the area, operating out of the new office and warehouse in Decatur, Ga., a suburb of Atlanta. A graduate of the University of Georgia, he has been associated with St. Regis Paper Co. as packaging sales engineer, and most recently served as technical representative of Arabol Adhesives for the southern area. His appointment is part of an expansion program which will provide additional technical service in major industrial areas in the south, and which includes plans for construction of an adhesives plant in the Decatur area.

Dr. Richard A. Bafford, previously with W. R. Grace & Co., has joined the research center of Koppers Co., Inc., Monroeville, Penna., as research chemist.

Dr. Charles G. Bottomley and *Dr. Norman J. Rose* have joined the research staff of the Central Research Department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.

Edward Lavin has been named director of application research at the Research Department of Shawinigan Resins Corp., Springfield, Mass. *Dr. Aubrey F. Price,* director of product research and *Harold D. Weymouth* becomes director of research administration and planning.

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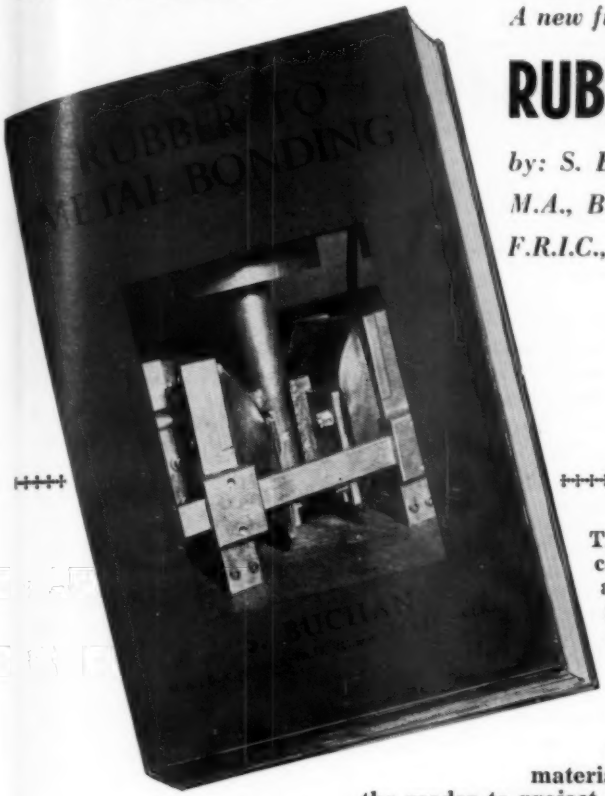

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July 17-21. Gordon Research Conference on Elastomers, Colby Junior College, New London, N.H.

July 17-21. Gordon Research Conference on Organic Coatings, Kimball Union Academy, Meriden, N.H.

July 18-21. The Chemical Society, Symposium on Inorganic Polymers, University of Nottingham, Nottingham, England.

July 24-28. Gordon Research Conference on Chemistry at Interfaces, Kimball Union Academy, Meriden, N.H.

Aug. 3-5. Chemical Institute of Canada, 44th Canadian Chemical Conference & Exhibition, Queen Elizabeth Hotel, Montreal, Quebec, Canada.

Aug. 6-12. International Union of Pure and Applied Chemistry, 18th International Congress and 21st Conference, Montreal, Quebec, Canada.

Aug. 7-11. Gordon Research Conference on Toxicology and Safety Evaluations, Kimball Union Academy, Meriden, N. H.

Aug. 15-18. Technical Association of the Pulp & Paper Industry, 12th Testing Conference, Queen Elizabeth Hotel, Montreal, Quebec, Canada.

Aug. 20-25. American Leather Chemists Association, International Union of Leather Chemists Societies, Shoreham Hotel, Washington, D.C.

Aug. 27-Sept. 6. National Academy of Sciences, 10th Pacific Congress, University of Hawaii, Honolulu, Hawaii.

Aug. 27-Sept. 1. Sixth International Conference on Coordination Chemistry, McGregor Memorial Conference Center, Wayne State University, Detroit, Mich.

Aug. 28-Sept. 1. Gordon Research Conference on Adhesion, New Hampton School, New Hampton, N.H.

Sept. 3-8. American Chemical Society, 140th National Meeting, Chicago, Ill.

Sept. 5-8. American Chemical Society, 11th National Chemical Exposition, International Amphitheatre, Chicago, Ill.

Sept. 5-15. International Packaging Exhibition, London, England.

Sept. 11-13. Technical Association of the Pulp & Paper Industry, 11th Corrugated Containers Conference, St. Francis Hotel, San Francisco, Calif.

Sept. 13-15. Armed Forces Chemical Association, 16th Annual Meeting, Statler Hotel, Washington, D.C.

Sept. 18-19. Chemical Market Research Association, Lake George Sagamore, Bolton Landing, N.Y.

Sept. 18-22. Instrument-Automation Conference & Exhibit, New York, N.Y.

Sept. 22-Oct 1. International Plastics Fair, Copenhagen, Denmark.

Sept. 24-27. American Institute of Chemical Engineers, 45th National Meeting, Lake Placid Club, Lake Placid, N.Y.

Portrait of

D. K. RIDER

Don K. Rider is a sub-department head in charge of Resins and Laminates Development at Bell Telephone Laboratories, Inc., Murray Hill, N.J. His area of responsibility includes four groups engaged in the development of adhesives, laminates, casting resins, and fiber and color.

Mr. Rider received his BS and MS degrees from the University of Michigan and went to work for the Resinous Products Division of Rohm and Haas Co. in 1941. He was engaged in resin synthesis, and applications research in adhesives, rubber chemicals, and polyester and ion exchange resins. He joined the Masslinn Division of Chicopee Mfg. Corp. in 1947 as a binder researcher in the field of nonwoven (bonded) fabrics. In 1948, he became a member of the technical staff at Bell Labs., working first on casting resins and then on adhesives and printed circuits.

A member of the ACS and ASTM's Committee C-19 on Structural Sandwich Constructions, Mr. Rider was previously active in the work of ASTM's Committee D-14 on Adhesives. In 1957, he served as chairman of the Gordon Research Conference on Adhesion.

Mr. Rider is a prolific author and in addition to numerous articles has contributed the chapter "Adhesives Guide for Designers" to Dr. Irving Skeist's forthcoming book on adhesives.

New Resyn Latices

National Starch and Chemical Corp., New York, N.Y., has introduced two new latices — a polyvinylidene chloride latex known as Resyn 3600, and a cross-linking acrylic latex, called X-Link Resyn 2833. Resyn 3600, when applied as a functional coating, is said to provide superior protective properties. In addition, the company states, it is a superior paper barrier coating, exhibiting excellent resistance to grease, water, water vapor, gas, and chemicals. The new latex can be applied as an "on machine" coating adaptable to all conventional types of paper coating equipment, and does not require additional converting operations such as laminating and extrusion.

L-Link Resyn 2833 is designed for saturation of cellulosic and synthetic fibers of all types, and is particularly suited for paper making applications which require strong yet flexible binders with a high degree of resistance to water, solvents and chemicals. The new polymer forms very strong, highly flexible films which reportedly show excellent heat resistance and non-discoloration under various conditions. It is also said to produce extremely high tensile strengths concurrently with very high tear characteristics, and is suited for many saturation end uses. No compounding or formulating is necessary to cross-link this resin, the company reports.

Increase Sales at Bemis

Bemis Bro. Bag Co. reports 1960 sales of $131,651,312, compared with $131,251,156 for 1959. Both earnings per share and net income for 1960 were the second highest in the past decade; income for the year totaled $2,869,328, equal to $4.03 per share, compared with $3,023,354, or $.24 a share in 1959. The company spent more than $2,750,000 on its plant expansion and modernization program during 1960. These expenditures were made both to expand output, and to increase manufacturing efficiency and reduce costs. The emphasis was on installing high-speed paper bag equipment, new printing presses, and modifications to existing equipment.

Daran Plant On Stream

Daran high barrier paper coating latex is now available in commercial quantities from a new plant recently placed on stream by the Dewey and Almy Chemical Division of W. R. Grace & Co. The facility is located at the division's Acton, Mass., organic chemicals plant, which produces butadiene-styrene latices and resins and polyvinyl acetate emulsions. The cost and capacity of the new facility were not disclosed.

Forms Applicon Machines

Avery Adhesive Products, Inc., Cleveland, Ohio, has formed a new division, Applicon Machines, which will provide equipment to facilitate the use of pressure-sensitive labels, rolls, and sheets. Machines immediately available under the Applicon trade name include pressure-sensitive label dispensers, both manual and electric, and pressure-sensitive label imprinters. The new division will be under the management of Seth Wheeler.

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Plans Building Exposition

The Industrial Building Exposition & Congress, held for the first time in December, 1960, will be produced again in 1961 at the New York Coliseum, from September 25 through September 28. Arrangements for the exposition are being made by Clapp & Poliak, Inc., New York exposition management firm. Exhibits will occupy the two main floors of the Coliseum. The program of the congress, which covered all major aspects of new construction and modernization, will be repeated this year.

Exhibits and program topics will be aimed at three types of audiences: companies which have a continuing program of building new plants; companies which rarely erect new plants but have one planned or under consideration; and companies which have problems of modernization. Exhibits will cover eight major categories: structural materials and components; mechanical components and equipment; electrical components, materials and systems; heating and air handling; employee services; plant sites and services; financing, and auxiliary services.

Armstrong Scholarships

Undegraduate scholarship awards have been renewed at ten universities, and graduate science fellowships at two by the Armstrong Cork Co., Lancaster, Penna. The awards, started in 1955, are part of the company's program to support higher education. The undergraduate scholarships, starting with the 1961-1962 academic year, have been renewed at Bucknell University, Drexel Institute of Technology, Franklin and Marshall College, Georgia Institute of Technology, Indiana University, Lehigh University, University of Pennsylvania, Pennsylvania State University, Rensselaer Polytechnic Institute, and Syracuse University. The graduate science fellowship was renewed at the University of Pennsylvania, and changed from chemistry to physics at Lehigh University. Armstrong has also established one new graduate science fellowship at Ohio State University.

Pee Cee Names Three

Pee Cee Tape & Label Co., Los Angeles, Calif., has appointed James Coleman, formerly sales engineer, as its regional sales manager in the Dallas-Ft. Worth, Texas, area. Norm Hall, eastern operation manager, has been transferred to Dumont, N.J., where he will also supervise new product activities, and Newell Franks has been appointed plant manager at St. Louis, Mo. Pee Cee's new personnel appointments are the result of a recent plant expansion in St. Louis, designed to meet an increased volume of business. The company reports that modern high-speed equipment has been installed, and the plant's productive facilities have been doubled.

Woodhill Repair Kit

A new plastic gutter and downspout repair kit, designed for home repair of leaking gutters, downspouts and joints, has been introduced by Woodhill Chemical Co., Cleveland, Ohio. The new kit provides a self-soldering, plastic impregnated patch that adheres indefinitely, according to Woodhill, to both painted and bare metal surfaces.

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by JOYCE HURD

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patent review

By MELVIN NORD

Applying Pressure-Sensitive Adhesive to Sheet Material

U. S. Patent 2,965,066, issued December 20, 1960 to Hans C. Paulsen and assigned to United Shoe Machinery Corp., provides an apparatus for applying to a limited area of a price tag or other form of sheet material a suitable pressure-sensitive adhesive coating for attachment to an article of merchandise.

The apparatus is intended for use in processing and applying pressure-sensitive adhesives in film form to sheet material. The adhesives involved are too viscous for application by other than power spreading or lack the ability to hold together as a film in a cooled condition without rupturing when applied to sheet material. One advantage of utilizing such viscous adhesive films is that characteristics of immediate utility and unusually strong adhesive power are demonstrated as a result of rapid cooling only, as distinguished from adhesives requiring drying of solvents. Thus, the apparatus is particularly effective in processing and applying polyvinyl ethyl ethers mixed with a styrene polymer resin or similar solvent-free mixtures of thermoplastic resins. These pressure-sensitive adhesives are processed by heating them to a temperature of about 350°F., at which temperature the adhesives still exhibit a viscosity of about forty thousand centipoises.

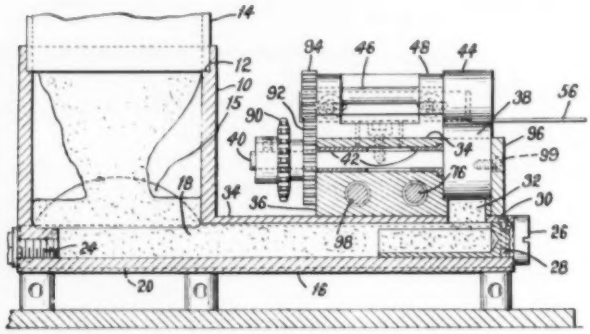


Figure 1

As shown in Figure 1, the apparatus provides a vertical cylindrical supply reservoir (10) having at its upper end an internal counterboard shoulder (12) fitting the mouth of a common form of commercial paper board supply container (14). When the supply container is inverted and disposed within the counterbore above the shoulder (12), the contents of the container are suspended and upon application of heat to the reservoir the adhesive gradually is carried by gravity into the heated bottom of the reservoir which has angularly disposed bottom surfaces (15) declining toward each other. The reservoir has a laterally projecting base (16) formed with three parallel passageways disposed in a horizontal plane and running from the base from beneath the reservoir.

The central passageway (18) has its rearward end entering the reservoir at the apex or lower ends of the angularly disposed surfaces (15) to conduct heated adhesive from the reservoir into the passageway. The two outside passageways are fitted to have inserted in them electrical heating cartridges (20), the cartridges extending within wedge shaped bottom portions of the reservoir beneath the declining surfaces (15) to provide close fitting support. The rearward end of each cartridge lying beneath a declining surface (15) insures proper heating of the adhesive in the reservoir for drainage into and through the passageway (18).

The rearward end of the adhesive conducting passageway (18) is plugged by a capscrew (24). The forward end is plugged by a valve body (26) having a slotted enlarged head with a groove (28) into which extends the reduced end of a threaded pin (30) engaging a threaded opening in the base (16). The arrangement is such that the valve (26) may be rotated to uncover or to close the lower end of an outlet opening (32) running from the adhesive passageway (18) through an upper finished surface (34) on a block (36) forming a part of the laterally projecting base (16). The inner part of the valve (26) is trough shaped with one side open, so that when the open side is aligned with the lower end of the outlet opening (32), the adhesive may flow upwardly into the outlet opening.

The upper end of the outlet opening (32) is enlarged to receive and fit an adhesive applying roll (38) secured to the forward end of a shaft (40). Cooperating with the adhesive spreading roll (38) is a pressure roll (44) secured to the end or a horizontal shaft (46).

If a price tag or other flat article composed of sheet material (56) is guided between the rolls, it will pick up a thin layer or film of the adhesive. To prevent transfer of thick adhesive from the adhesive applying roll into contact with the pressure roll (44), the latter is held raised from the adhesive applying roll a short distance less than the thickness of the tag (56) by an adjusting screw.

Polyurethane to Fabric

U. S. Patent 2,976,202, issued March 21, 1961 to Samuel Salem and Donald W. Anderson and assigned to The General Tire & Rubber Co., describes a process of bonding a fabric of a long chain polyamide having a high melting point to a flexible elastomeric reaction product, free of aliphatic chemical unsaturation, of about one mole of a generally linear long chain polyhydroxyl-containing polymer (a polyester or a polyether), and about one mole of an organic diisocyanate.

A coating is formed on the fabric, composed essentially of an infusible insoluble resin, by applying to the fabric an aqueous solution consisting essentially of dihydroxy phenol and sufficient formaldehyde to form an insoluble resin, together with a resin-forming catalyst. The fabric is heated sufficiently to convert at least a portion of the phenol and formaldehyde to form an insoluble resin. The elastomer is cleaned with an organic solvent to provide a clean surface for bonding. The fabric is calendered to the elastomer, and they are then subjected to a curing temperature.

Thermoplastic Adhesives

U. S. Patent 2,975,150, issued March 14, 1961 to Eric C. Johnson and Robert D. Clarke and assigned to B. B. Chemical Co., provides a solid rod of a resinous thermoplastic mixture of adhesive components heretofore considered incompatible with each other.

The composition consists of a milky appearing dispersion of solid particles of one component distributed in a continuous solid phase of a second component. The mixture of components when at elevated temperature is a clear viscous liquid. The proportion of one component relative to the other is sufficiently high so that on cooling, the composition separates to develop the milky state in the solidified mixture.

The rod has a cross-section of about ⅛-inch to ¼-inch in thickness, and it is sufficiently rigid to be fed longitudinally, but adequately flexible to be coiled.

Gummed Paper

U. S. Patent 2,976,178, issued March 21, 1961 to Walter H. Pahl, Willis A. Sandholtz, and Nicholas R. Elerts and Richard E. Goggin, assigned to Minnesota Mining & Mfg. Co., provides a flexible gummed sheet product exhibiting high adhesive strength.

The product consists of a flexible fibrous sheet backing member and a normally non-tacky gummed coating on it. The dry coating weight of the coating is 5-15 pounds per ream. The coating is rapidly activated to tackiness by water-moistening. It contains up to 95 per cent weight of high solubility dextrine exhibiting a viscosity below 50 centipoises Brookfield at 100°F. and 30 per cent solids concentration in water, and a solubility of at least 90 per cent in water at 77°F. It also contains 5-40 per cent of water-soluble acrylyl polymer (polyacrylic acid or polyacrylamide). The dextrine and acrylyl polymer are uniformly blended in the gummed coating of the paper.

Self-Bonding Material

U. S. Patent 2,973,088, issued February 28, 1961 to Peter J. Canterino and assigned to Phillips Petroleum Co., provides a material which is capable of adhering to itself.

The material consists essentially of a blend of (1) a chlorinated polymer of aliphatic 1-olefins having no more than four carbon atoms per molecule, the polymer prior to chlorination having a density of at least 0.94 at 25° C. and a crystallinity of at least 70 per cent at 25° C., and containing 40-60 weight per cent of chemically combined chlorine, and (2) 2-25 parts by weight per 100 parts of chlorinated polymer of a compatible plasticizer.

Preparation of Starch

U. S. Patent 2,974,068, issued March 7, 1961 to Freerk J. Fontein and assigned to Stamicarbon N.V., describes a process for preparing starch from basic starch-containing materials, by which a suspension containing starch particles and impurities is purified.

The suspension is screened to obtain at least one intermediate fraction containing particles the largest of which are at least of the same size as the largest starch particles and the smallest of which are of a size intermediate between the largest and smallest starch particles. This intermediate fraction is then separated by settling rate into a pure coarse starch fraction and a fraction containing the impurities.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Tape applicator	Cellotape & Tag Printers	2,972,428	2/21/61
Applicator for adhesives	LaFrance Carpets, Inc.	2,972,773	2/28/61
Sealing compositions	American-Marietta Co.	2,973,279	2/28/61
Bituminous road-surfacing materials	Alfred R. Lee, et al	2,973,281	2/28/61
Solvent-resistant pressure-sensitive polyacrylic adhesive tape	Minnesota Mining & Mfg. Co.	2,973,286	2/28/61
Adhesive bandage	Johnson & Johnson	2,973,859	3/7/61
Tape dispensing mechanism	Minnesota Mining & Mfg. Co.	2,973,890	3/7/61
Foundry core binders	International Minerals & Chemical Corp.	2,974,048-50	3/7/61
Production of gypsum plaster	Societe des Gypses et Platres deFrance	2,974,939	3/14/61
Heat resistant adhesive article	W. H. Brady Co.	2,975,091	3/14/61
Flocculation of fine particles by starch ethers	National Starch & Chemical Corp.	2,975,124	3/14/61
Tape dispenser	Mystik Adhesive Products, Inc.	2,975,950	3/21/61
Adhesive composition	Rohm & Haas Co.	2,976,203-4	3/21/61

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D.C., for 25 cents each. Do not send stamps.

new equipment

M-D Caulking Gun

M-D model CG-4 Caulking Gun features a built-in cut-off knife blade on the trigger. On the gun handle itself is a beveled hole into

which is inserted a tapered plastic nozzle with four places molded into its shape, permitting a choice of four different size nozzle openings. The gun is operated by squeezing the trigger to cut off the tip of the nozzle, then the speed load is slipped into the gun, which is ready to start caulking. *Macklanburg-Duncan Co.* **E-330**

Portable Price Marker

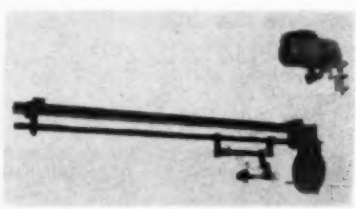
A portable price marking machine, Model A-58 is said to be capable of imprinting as many as 150 pressure-sensitive labels per minute. With accessories, the unit can imprint labels with such information as price, name of company, local taxes, and special messages. Changes in price numbers can be accomplished in a few seconds by simple dial adjustment, and the model is equipped with an automatic counter, so that precise quantities of labels can be imprinted. The standard model contains a five-digit print head, and guides for imprinting label widths up to 11/ 16 inches. Another model, the A-58 Special, includes a counter and an eight-digit, double-dial print head. It handles labels in widths up to 1 7/16 inches. The pressure-sensitive labels are printed from rolls, and then removed from the backing paper and affixed to merchandise. *Avery Label Co.* **E-331**

Masking Spray Coater

The HD-3 Remote Masking Spray Coater, designed for automatic continuous organic finishing of electrical and electronic components, has been re-engineered to accept either adjustable or portable magazines, thus permitting the full usage of the handling facilities provided by the manufacturer's Tray Loader and Magazine Loader. According to the company, the revision makes possible the use of the spray coater for adjustable or portable magazines according to the handling rate of the components required. The rate of production of coated components can thus be regulated to meet the demand. The unit is adjustable as to size of the components within the assigned range. *Conforming Matrix Corp.* **E-332**

Glue Applicator Positioner

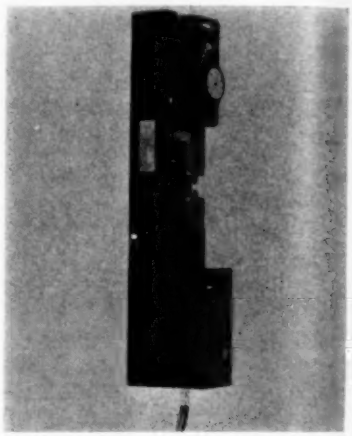
Model D-10A-GN Glue Applicator Positioner automatically positions a glue wheel or nozzle on a paper bag machine or tuber, maintaining the location of the glue seam in relation to the edge of the web. This insures the proper location of the adhesive and eliminates the possibility of the bags sticking on the inside or sticking



together on the outside when they are stacked. The manufacturer states that accurate control of the glue nozzle position often makes it possible to reduce the width of the seam overlap, resulting in substantial paper savings. The model includes a sensing head, diaphragm type power unit, and motor-vacuum pump. *Fife Mfg. Co., Inc.* **E-333**

Portable Tensile Tester

Tensile tests up to 500 pounds can be performed on a new portable instrument, the Series TJ Tensile Tester, with an accuracy of one-half of one per cent of the full scale reading. The air-actuated, bench-mounted unit is said to be ideal for production testing and for exacting laboratory tensile measurements, and will test a variety of



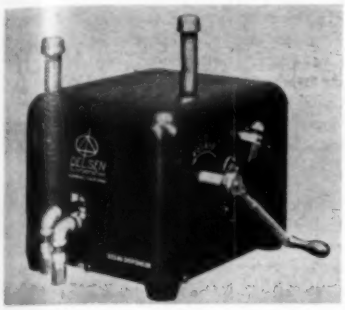
small parts or material samples, such as bonded, wire, or strip parts, which are held in its plier-like, in-line grip. The testing unit makes use of the Hunter Force Gage, a direct-reading gauge for measuring tensile and compressive forces. Maximum jaw opening of the tester is ¼-inch; maximum travel of moving jaw is 2 inches; and minimum sample length is 1 inch. These factors can be varied, however, by modification of the instrument or by simple adjustment. Seven models offer maximum capacities of 20, 50, 75, 100, 150, 200 or 500 pounds. *Hunter Spring Co.* **E-334**

Carton Sealer

The Lexam gluer is designed to seal cartons more securely than gummed tape or staples, and the cartons are both neater in appearance and safer in transit, according to the manufacturer. Using low-cost liquid adhesives, the unit dispenses the adhesive in an even coat to any size area with the utmost flexibility. The advantages are said to be its speed and ability to use ungummed labels. The unit is portable and weighs approximately 3½ pounds. *Ever-Seal Industrial Glues, Inc.* **E-335**

Resi[n] Dispenser

By providing a greater range of resin-hardener ratios, the Model 395 Variable Ratio Resin Dispenser is said to give much flexibility in



metering two-component liquid resin systems. By means of a simple lever adjustment, the ratio of resin to hardener can be varied from about 20:1 to 1:1. According to the manufacturer, use of the dispenser allows rapid change over from one resin-hardener to another, and changes in resin to hardener ratio can readily be made in order to compensate for changes in ambient temperature. A reference scale is provided so that ratios may be accurately reset. Provision is made for locking to prevent unintentional changes in the resin to hardener ratio. Model 395 is available in both hand operated and motor driven models. *Delsen Corp.* **E-336**

Infrared Muffle Oven

The Redi-Ray modular muffle oven utilizes the advantages of infrared heating by focusing all the heat directly on the work as it passes through an inner cylinder. The oven is said to provide high-speed heating with close temperature control for curing a wide variety of materials. Its inner cylinder is a high-emissivity surface generating infrared radiation. Resistance wire elements are utilized to bring the surface to radiation temperature. The unit can be held constant at any temperature within close limits, with interior temperatures as high as 1500°F. *Infrared Systems, Inc.* **E-337**

FOR MORE INFORMATION on these new products use the Reader's Service Coupon on page 56.

Tape Coder

Gummed tape can be printed and dispensed at the same time with the 1-C Tape Coder attachment for the manufacturer's electric Dial-Taper. The tape printing attachment prints code marks, contents, parts numbers, dates, and trade marks, with quick change base-lock rubber type, and fast drying, non-smear ink, as the tape comes from the machine at 3 feet per second. As the length of tape is dialed, the machine prints the tape, measures it accurately, cuts off the correct length, and applies warm water to the tape. *Marsh Stencil Machine Co.* **E-338**

Kinematic Viscosity Bath

The Kinematic Viscosity Bath Model SIS 3802 is said to have increased speed resulting from direct reading, reduced error since there are no conversion calculations to make, and a continuous range of measurement. Constants are exactly as listed in ASTM D-445, and calibrations are furnished to within ±0.1 or 1 per cent of listed value as a standard procedure. The unit has a six tube capacity and offers a range of 70° to 400°F., with a uniformity of ±0.01° up to 250°F. *United States Testing Company.* **E-339**

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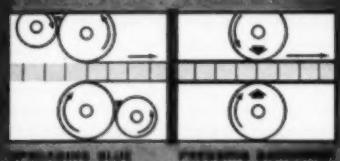

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book reviews

Symposium on Adhesion and Adhesives. *Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna. 6 x 9 in. 66 pp. $2.25.*

(Available from ADHESIVES AGE)

This volume, devoted to metal bonding, makes available in printed form three papers first presented at the 3rd Pacific Area National Meeting of ASTM in San Francisco, in October, 1959. The symposium was sponsored by Subcommittee XI on Metal Bonding Adhesives, of Committee D-14 on Adhesives.

In addition, the book contains two other papers devoted to the same areas of research. One of these covers the final report of a study undertaken by D-14 to determine the effects of increases in rates of loading in Method D-1002-53T. The second, on shear testing of metal-to-metal bonds, was originally presented at the 63rd Annual Meeting of ASTM in June, 1960 and thus appears in ASTM Special Technical Publication No. 289.

In his Introduction, Steven Yurenka, the Symposium chairman, states that "Although it is neither a complete nor an extensive study of the problems relating to adhesives, it is hoped that this volume will at least help to answer some of the many questions of those engineers who have required additional encouragement before using adhesives in their designs."

It is evident that most of these engineers will be involved in working out the design problems in aircraft and space vehicles. Mr. Hahn, author of the first paper, is a research engineer at Douglas Aircraft Co.; the second paper reports work done at Narmco Industries, Inc., supported "in whole or in part" by the United States Air Force; L. E. Gates and W. E. Lent, authors of the third paper, are affiliated with Hughes Aircraft Co.; and the last paper presents conclusions of a study done at Convair, Division of General Dynamics Corp. The fourth is the one exception.

The paper titles, and their authors, are as follows: Lap Shear and Creep Testing of Metal-to-Metal Adhesive Bonds in Germany, by K. F. Hahn.

Elevated Temperature Resistant Metal-to-Metal Adhesives Derived from Organic-Inorganic Polymer Systems, by E. C. Janis.

Preliminary Evaluation of Ceramic Adhesives for Stainless Steel, by L. E. Gates and W. E. Lent.

Tensile Shear Strength of Adhesive Bonded Metals as a Function of the Rate of Loading, by D. A. George, John Mandel (National Bureau of Standards), and H. R. Butzlaff (A. O. Smith Corp.).

Bonded Metal-to-Metal Shear Testing, by L. R. Lunsford.

Polymeric Materials. *By Charles C. Winding and Gordon D. Hiatt. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y. 6¼ x 9¼ in. 406 pp. $12.00.*

Polymers are the primary materials in the plastics, rubber, protective coating and textile fiber industries. Although these four industries developed separately and even today have separate sales and technical service forces where single companies overlap them, the authors have seen a need for a text which is unified, and covers the common denominator of them all. Their working assumption is that "For an engineer or scientist, a broad general background in polymeric materials, not restricted by industries, is desirable regardless of specific employment." In this context, then, they have provided an introductory volume which concentrates on the chemical, physical and engineering aspects of polymers.

The success of the volume is accordingly dependent on the clarity and organization and scope and depth of the material selected. Fortunately, both authors have used substantial portions of the manuscript as lecture notes in introductory courses on polymeric materials for several years prior to publication date. They report that students have readily accepted the order of presentation of material which they have incorporated here. This involves an initial introduction to the chemistry of polymers, including molecular structure and properties. This is followed by applications and fabrication methods. The first part thus covers fundamentals that are common to many polymers; the second contains detailed discussions of specific commercial polymers.

By way of general comment, it should be mentioned that charts, tables and listings are exceedingly clear and straightforward. Typography is good.

A listing of the specific chapters follows: (1) Polymer Structure and Polymerization Reactions (2) Solutions and Molecular Weights of Polymers (3) General Properties of Plastics (4) and (5) General Applications of Polymeric Materials (6) Natural Products and Their Derivatives (7) Polymers formed by Condensation Reactions (8) Ethenic Polymers (9) Silicones (10) Rubbers.

Trade Literature

Aroclor Plasticizers. More than 100 formulations for the use of Aroclor compounds as fortifying extenders and plasticizers in a wide variety of resins are contained in Technical Bulletin No. PL-306. The booklet lists detailed specifications and physical characteristics of these inert, chlorinated biphenyls and polyphenyl. It also provides data on their applications in polyvinyl chloride, elastomers, cellulosics, polyesters, epoxies, etc. *Monsanto Chemical Co.* **L-381**

Epoxy Resins Bibliography. Technical Bulletin SC:60-131 contains a bibliography of 703 magazine articles dealing with epoxy resins. The 40-page bibliography lists the magazine articles under six headings: general, which includes chemistry, analysis, testing, properties, fillers, reinforcement, and modifications; adhesives; structural applications; surface coatings; textile applications, and physiological effects. *Shell Chemical Co.* **L-382**

Jet Cooking System. The latest applications of an automatic jet cooking system are described in this 20-page publication. According to the booklet, the system does away with batch starch cooking difficulties, and automatically provides a continuous flow of starch paste with consistently uniform concentration, cooked properties, temperatures, and viscosity. *A. E. Staley Mfg. Co.* **L-383**

Coated Abrasives. Titled "Catalog of National Standard Abrasive Belts, Rolls, Sheets and Discs," this 50-page booklet lists standard coated abrasive products used throughout industry. The literature points out that all items listed are maintained in stock at the manufacturer's warehouses by electronic order processing and inventory control. *Carborundum Co.* **L-384**

Case Sealing Adhesives. Complete data on adhesives types, physical properties, common case sealing problems, and application information are available in Technical Report No. G3-101. The report covers both dextrine and resinous emulsion type glues. Also included are tables showing the influence of dilution on viscosity characteristics, and technical data such as solids, pH, color, weight per gallon, storage life, speed of set, and methods of application for 13 adhesives specifically designed for modern case sealing operations. *Borden Chemical Co.* **L-385**

Maglites in Neoprene Adhesives. The use of two special active grades of magnesium oxide, Maglite D and M, in neoprene adhesives is covered in this four-page technical service bulletin. The bulletin points out that the Maglites aid in retarding scorch during mixing.

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- **Adhesive Bonding of Reinforced Plastics—H. A. Perry. $8.75.** Survey of the design and assembly of structures and products, particularly glass-fiber-reinforced plastic products, by means of adhesives. Gives data on equipment and methods used to produce adhesive bonded joints. ☐

- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice —A. X. Schmidt and C. A. Marlies. $14.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives, their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research —G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Epoxy Resins—Irving Skeist. $5.50.** A chapter on adhesives is included in this complete study of the entire field of epoxy resins. The author gives formulations, trade names, methods of manufacture and applications. ☐

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Trade Literature (Cont'd.)

lengthening shelf life of the adhesive and improving tack retention properties. Procedures for stock and adhesive preparation are included, as well as a comparison of the two Maglite grades in Neoprene AC and W adhesives. *Merck Marine Magnesium Division, Merck & Co.* **L-386**

ADHESIVES FOR MYLAR. Three classes of adhesives for use of bonding Mylar film to a variety of substrates and to itself are covered in this eight-page, illustrated brochure. The brochure, called Bulletin 17, discusses the characteristics, advantages, properties, methods of application, and typical uses of the three adhesive types—modified synthetic rubber, polyester, and vinyl. *E. I. du Pont de Nemours & Co.* **L-387**

PACKAGING CHART. Box closing using a single strip application of reinforced sealing tape is illustrated in this 36 by 24 inch, four-color wall chart. The chart provides instructions concerning recommended storage and handling of reinforced tape and lists all carriers authorizing the use of reinforced tape and the Federal specification covering the products. *Atlantic Gummed Paper Corp.* **L-388**

SPECIAL COATINGS. Eighteen special industrial coatings are described in this four-page, two-color folder. The coatings fall into four general chemical categories—resin emulsions, wax emulsions, solvent-base waxes, and self-polishing solvent-base waxes and resins. *S. C. Johnson & Son, Inc.* **L-389**

WOODWORKING ADHESIVES. Characteristics and properties of 13 resin-base adhesives and animal glues for the woodworking industry are described in this eight-page catalog. Designated Catalog No. A-200, the two-color booklet also cites specific applications and advantages of each type of bonding material. *Armour Alliance Industries.* **L-390**

ENVELOPE ADHESIVE. An envelope adhesive called Flash Seal is described in this 10-page booklet. Discussed are the origin and development of the adhesive, its operation, manufacturing advantages, and how to set up and run Flash Seal adhesive. *Stein, Hall & Co.* **L-391**

SYNTHETIC RUBBER SEALING TAPE. A new sealant called Pressureseal is the subject of this two-page publication. Pressureseal is described as double insurance for a positive, lasting seal. It combines an elastic compound tape for a more intimate bond and a neoprene core to provide more give and take. *American-Marietta Co.* **L-392**

PASTE DEFOAMER. Literature is available on a new water dispersible paste-type defoamer, Nopco NZH, designed for use in the production of both animal and bone glue. The new defoamer is said to be effective in controlling foam when used in amounts as low as one-quarter to one-half per cent on the weight of the glue, and to give excellent "smear" tests without fish-eyes. *Nopco Chemical Company.* **L-393**

RESIN FOR NEOPRENE ADHESIVES. This four-page publication presents the latest technical data on SP-134, a new, light-colored, heat-reactive, phenolic resin for industrial and general purpose elastomer adhesives. Included are pictures and graphs depicting tensile shear, peel back and pre-reacting resin test data. *Schenectady Varnish Co., Inc.* **L-394**

FOR MORE INFORMATION on the literature items described here, use the Reader's Service Coupon on page 56.

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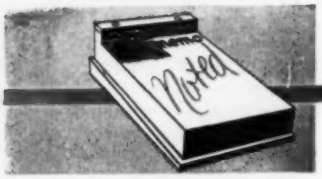

in passing

A Rose By Another Name

Let's hope that none of our readers is so thoughtless as to suppose that those leisurely Madison Avenue lunch hours make no contribution to the definition of our "national purpose." The literate lads and lassies have invented a painless game for relating the past to the present:

Take a well known advertising slogan and find a famous literary quote that parallels it. Any number can play. Keep a "Bartlett's Familiar Quotations" handy.

Slogan: "Remember how great cigarettes used to taste?"

Quote: "Tobacco, divine, rare, superexcellent tobacco which goes far beyond all the panaceas, potable gold and philosopher's stones, a soverign remedy to all diseases." (Burton's "Anatomy of Melancholy")

Slogan: "Is it true blondes have more fun?"

Quote: "Fair tresses man's imperial race ensnare, and beauty draws us with a single hair." (Pope's "The Rape of the Lock")

Slogan: "Don't let romance fade, fade away."

Quote: "With that rich perfume of her breath, she blasted the very air." (Hawthorne, "The Old Manse")

Etc., etc., etc.

Who, Me?

A confirmed tippler, at long last been cured of the sauce, was receiving a final check up from his psychiatrist who was making sure that his responses were "right."

"Tell me," said the doctor, "what does the name Gordon suggest to you?"

The salvaged soul paused. "Wasn't that the name of a British general?" he said at last.

"Excellent," said the witch doctor rubbing his palms together enthusiastically. "And what does the name Haig mean to you?"

"He was a famous Earl," came the prompt reply.

"Wonderful! And now for the final question. What does Vat 69 mean to you?"

"Why that must be the Pope's telephone number," answered the obviously reformed souse.

An International Affair

Somebody recently defined the jet age as "breakfast in London, lunch in New York, dinner in San Francisco and baggage in Buenos Aires.

Things to Come

Speaking at a recent symposium on "New Materials for the Building and Construction Industry," Dr. Clyde Williams, president of Clyde Williams and Co., Columbus, Ohio, pointed out that important ideas for new products often come from technologies having no apparent relation to the industry in question.

For example, he noted that a solution to the age-old problem of developing better holding power in the common nail might very well come from organic chemistry. Technicians with a knowledge of the cross-linking of molecules might enable the production of nails that would gradually combine molecularly with wood fibers.

This Side of Paradise

In the southeastern part of Michigan is a tiny community called Hell which until recently highway department officials have piously refrained from putting on the map. However, the pressure has gotten too great. It seems that a lot of people want to go there.

"We decided to put Hell on the map," reports Commissioner John C. Mackie. His department, however, also recommends that motorists drop in on Paradise, located 50 miles north of Sault Ste. Marie.

My Fair Lady

What is she carrying in those enormous handbags? Would-be thugs, robbers and over-eager Don Juans are hereby warned that it may be a Pengun, a handy little item put out by a Pennsylvania company. No bigger than an ordinary fountain pen, this gadget lets loose an eight-foot blast of tear gas that temporarily renders an attacker helpless. It can also fire signal flares that ignite at about 150 feet.

Metered Martyrdom

When Copenhagen cops reported that parking meters on streets closed to traffic were still collecting coins, an investigation revealed an interesting aspect of Danish courtship rites. When the swain Dane arrives at his streetcorner rendezvous, he slips a coin into the meter as evidence to the dame Dane of how long he has been waiting.